MALI

AGRICULTURAL SECTOR ASSESSMENT

Final Report
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ABBREVIATIONS USED IN THIS REPORT

BDM	Banque de Développement du Mali
BDPA	Bureau pour le Développement de la Production Agricole
CAA	Centre d'Apprentissage Agricole
CAR	Centre d'Animation Rurale
CEEMAT	Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical
CFDT	Compagnie Française pour le Développement des Fibres Textiles
CMDT	Compagnie Malienne pour le Développement des Textiles
CNPER	Commission Nationale de Planification de l'Economie Rurale
FAC	Fonds d'Aide et de Coopération (France)
FED	Fonds Européen de Développement
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IER	Institut d'Economie Rurale
IFAC	Institut Français de Recherches Fruitiers Outre-Mer
IPR	Institut Polytechnique Rural (Katibougou)
IRAT	Institut de Recherches Agronomiques Tropicales et des Cultures Vivrières.
IRCT	Institut de Recherches du Coton et des Textiles Exotiques.
IRHO	Institut de Recherches pour les Huiles et Oléagineux
ITEMA	Industrie Textile du Mali
OCLALAV	Organisation Commune de Lutte Anti-Aviaire et Anti-Acridienne
OICMA	Organisation Internationale contre le Criquet Migrateur Africain
OMBEVI	Office Malien du Bétail et de la Viande
OMVS	Organisation pour la Mise en Valeur du Fleuve Sénégal
OPAM	Office des Produits Agricoles du Mali
OSRP	Office de Stabilisation et de Régulation des Prix
PAR	Point d'Appui de la Recherche
PEP	Point d'Expérimentation Permanent
SATEC	Société d'Aide Technique et de Coopération
SCAER	Société de Credit Agricole et d'Equipement Rural
SEAE	Secrétariat d'Etat aux Affaires Etrangères Chargé de la Coopération (France)
SEDES	Société d'Etudes pour le Développement Economique
SEPAMA	Société d'Exploitation des Produits Arachidiers du Mali

SEPOM	Société d'Exploitation des Produits Oléagineux du Mali
SISCOMA	Société Industrielle Sénégalaise de Constructions Méchaniques et de Matériels Agricoles
SMECMA	Société Malienne d'Etudes et de Construction de Matériel Agricole
SOMASAC	Société Malienne de Sacherie
SONATAM	Société Nationale des Tabacs et Allumettes du Mali
ZER	Zone d'Expansion Rurale

CURRENCY EQUIVALENTS

Currency Unit	=	Mali Franc (MF)
US $1	=	475 MF
1 MF	=	US 0.21 ¢

WEIGHTS AND MEASURES

1 millimeter (mm)	=	0.039 inch
1 centimeter (cm)	=	0.394 inch
1 kilometer (km)	=	0.6214 mile
1 kilogram (kg)	=	2.2 lb.
1 metric ton (T)	=	2,205 lb.
1 hectare (ha)	=	2.471 acres

Note: This report uses the agricultural year, which begins in June and ends in May of the following year, e.g. 1975-76 means June 1975 - May 1976.

INTRODUCTION

One of the striking things about Malian agriculture is the progress that appears to have been made. Travelling in the central and southern parts of the country, one is impressed by the number and extent of fields that have been prepared with animal traction. In fact, World Bank officials familiar with Mali believe it has more draft animals, better tools, and wider use of modern techniques than any of its neighbors. Although much agronomic research remains to be done, it seems evident that technology now being used has considerable potential for further increases in the productivity of Malian land and labor.

There is nothing unusual about the content of this technology. It involves the kinds of things -- selected seed, animal traction, fertilizers -- that are usually recommended in such circumstances. At this point it may be worth raising some of the questions posed by the existence of new techniques as well as by a widespread concern for the state of crop production in the Sahelian states of Africa.

We argue below that Mali is today self-sufficient in cereals production, barring another durable drought. If this is true, what will result from the continued spread of technology? Is there danger of overproduction of cereals? or will serious bottlenecks occur in processing, storing, shipping and marketing? What will be the effects of the establishment of a security stock to tide the country over initially in case the drought returns? And what will happen to cash crop production?

We offer tentative answers to these questions in this report, but they in turn raise other, more difficult ones. What sort of Malian farmer is using the new techniques and why? Who is not using them and why not? Are they profitable for cash crops but not for cereals? Does it matter if they are not profitable for cereals? On what basis do farmers make their decisions about inputs, including land, to be used for different crops? What considerations prompt them to sell or not to sell cereals? We try to probe these questions, but we have no real answers.

The common thread is that most answers depend on having some understanding of Malian farmers.[1] It is also tempting to think there are basically only two types of farmers in Mali: a relatively small number of innovative farmers who have adopted new techniques on the one hand and the great mass of traditional farmers who are not yet open to change on the other. Actually, the picture is made more complex by the presence of traditional farmers who have adopted some new techniques but not others and by innovative farmers who have obtained animal traction equipment but have returned to less productive habits. Should the development effort be concentrated on any one of these groups, or on several groups in a particular rural zone, or on the entire mass? In theory the policy of the Malian government is not to concentrate on the more advanced farmers. As one of the preliminary studies for the current Five-year Development Plan stated, "the desired increases in production [should] result from an across-the-board rise in productivity and [could] in no case result from perfecting the techniques of a minority of pilot farmers."[2] In practice, however, the natural and understandable tendency of Mali's limited number of extension personnel seems to be to concentrate on the larger, better equipped pilot farmers. It may well be that the rather spectacular increases in output that have occurred in the two post-drought years have been the work of these advanced farmers, whose productivity potential was building up during, but was camouflaged by, the drought. It is an important question because if it is true, it probably means that the next spurt in growth is going to be somewhat harder to attain.

How can the productivity gains that seem to have been achieved by a certain number of farmers be attained by a significant segment of the sector? We do know that there are a number of new techniques that can be profitably used under certain circumstances. In the course of this study we would have liked to have concluded that particular technological

packages are unquestionably viable under present conditions and should be extended forthwith to the mass of Malian farmers. Unfortunately, we cannot. The rather vast scope of the assessment we were asked to undertake, with requirements for considerable description of the agricultural sector, and the limited means at our disposal have combined to prevent us from drawing any definite conclusions in this regard. The knowledgeable reader will not be surprised when we say that the complexity of the agronomic, ecological, economic and cultural issues that face the agricultural sector in a country like Mali cannot be adequately explored in a report such as this. There is much research that remains to be done at the farm level, on a regional or zonal level, and for the country as a whole to determine a number of basic facts. Anyone who has begun to study the agricultural sector in Mali or in some of the neighboring countries is familiar with the difficulties encountered in obtaining essential data. Even when at one point in time a relatively good estimate has been made of, say, national rice production or the use of a particular input in one region there is seldom a reliable context for comparison. In particular, good time series data are sorely lacking. On occasion we will remind the reader of this problem, but it should be emphasized at the outset that all of the statistics used in this study should be treated with caution.

We have relied quite heavily on the work of the National Commission for Planning the Rural Economy (CNPER), which put together three impressive volumes on the rural sector as it existed in 1971-72, when the present Five-year Development Plan was being conceived. In many domains the CNPER final report contains the best set of data that has ever been assembled on Malian agriculture. Unfortunately, it was a one-time effort, and for most topics statistics of comparable value have not been produced since. There does exist an annual survey of a sample of the agricultural sector, called the Enquête Agricole. Begun in 1966-67, the Enquête was well conceived and was executed with some

rigor in the first couple of years. Subsequently it does not appear to have been so well done. While we refer to it in the absence of better information, it is now a source of data that should be treated with skepticism.

It does not require further research for one to see that the principal dilemma facing the Malian Government at this juncture is that it is attempting to attain a number of objectives simultaneously when there is inherent conflict between some of them. The government wishes to control markets for agricultural production so that it may:

(a) insure that consumer prices for staple foods are low enough to be consistent with the government's incomes policy;

(b) earn revenues to finance public services; and

(c) supply cereals to urban areas and grain-deficit zones

At the same time it is also government policy to:

(1) permit farmers to earn enough from their crops to purchase agricultural implements and thus improve their productivity;

(2) remove the export-crop Development Operations from the national budget and make them self-financing; and

(3) extract savings from the rural sector in order to provide investment funds for national industries.

The difficulty in trying to reach these goals simultaneously is compounded by Mali's severe balance-of-payments problems and by national budget deficits. At the same time, inflationary pressures have become more acute in the past couple of years.

One of the government's principal tools in its attempt to control markets is the setting of official prices for agricultural output and for most purchased inputs as well. Producer prices were raised in 1974. However, despite inflation and the existence of significantly higher prices for the same crops in neighboring countries, they have not been raised since. Meanwhile, the government

has removed subsidies from agricultural implements, and their prices have risen substantially in the past two years. Fertilizer prices have also gone up. These developments have given to some the impression that the Malian farmer is supporting the rest of the population, which in effect means townspeople. As one official expressed it to us, "the farmer has had enough of subsidizing everyone else."

These preliminary comments should help to set the stage.

A final word on organization of the material: this report is a revised version of a draft prepared in August 1976. It contains four parts, the most important being Part II, which is devoted to consideration of some of the principal issues that face Malian agriculture. Part I is more descriptive in approach. It attempts to pull together in one place and to make available in English some of the more important pieces of information about the production and marketing of crops in Mali. Invariably, some discussion of issues and judgments have crept into the sections of Part I. The reader who is familiar with Malian agriculture may wish to skim these sections and concentrate more on Parts II and III. The latter is devoted to suggestions for consideration by the Malian Government as well as recommendations for US/AID. The Appendices in Part IV contain more detailed information on certain topics and a bibliography. To make matters easier, a short summary of Parts I-II starts on the next page.

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[1] Throughout this report we speak of the Malian "farmer", but he should not be thought of as the head of a nuclear family. In reality, the extended family that resides in one compound (called lu in Malinké or du in Bambara) is the basic farming unit. The decision-maker is the oldest male of the oldest generation. For a good description of the system, see William I. Jones, Planning and Economic Policy: Socialist Mali and Her Neighbors. Washington, Three Continents Press, 1976, chapter 8.

[2] CNPER Secretariat, "Project de Plan Quinquennal 1974-78: La Politique des Prix et les Coûts des Produits Agricoles," Annexes, p. 19.

SUMMARY OF PARTS I AND II

Part I: Description of the Agricultural Sector.

A. Only 1.5 percent of Mali's total land area is currently devoted to crop production. For the country as a whole, land is not a limiting factor. Food grains occupy almost 80 percent of the cultivated land, with peanuts and cotton taking 13 and 6 percent respectively. The two most recent years have yielded record or near-record results for all of the major crops with no increase in total cultivated area. (pp. 1-6)

B. Three major rice production projects use about four-fifths of the irrigated land in the country. In 1972 the total amount of irrigated land actually being farmed was 80,000 hectares. While planning the construction of large dams to reduce the economy's high vulnerability to poor rainfall, Mali has sought near-term self-sufficiency in rice and sugar by more modest means. In the case of rice the program has been successful ahead of schedule. (pp. 7-13)

C. About 90 percent of the total population lives in rural areas. On a national average, crop production provides 46 percent of agricultural income and animal husbandry provides 48 percent. Something less than one-half of all farms have any cattle, and even lesser percentages have either sheep or goats. There is some data on income distribution between rural zones but none on it within zones. (pp. 14-18)

D. Population movement in Mali is extensive and increasing. A good part of the migrant population consists of males between 20 and 40 who leave home to seek seasonal or permanent employment. (pp. 19-22)

E. In rural areas many aspects of Bambara and Malinké social organization are in transition, including land tenure systems and traditional production methods. A generation gap has become evident in areas of Mali that lie along the major arteries of commerce. There is an increasing tendency towards individualization of land tenure.

Nonetheless, the cooperative production systems continue to play an extremely important role. These systems rely on kinship, age-set and other coalitions that traditionally maximize food production under the constraints that face most farm units. (pp. 23-32)

F. The 1974-78 Economic and Social Development Plan divided Mali into eleven rural zones, which correspond in rough fashion with the areas covered by the so-called "Operations". These agencies, entitled to receive funding directly from foreign donors, have concentrated in the past on the production and marketing of a single crop. Today they are moving toward an integrated rural development approach. The present trend is leading toward the concept that all development activities in a rural zone could logically be directed by a single organization, the Operation. It has been difficult -- and may become more so -- to impose effective coordination on the Operations and keep them on parallel tracks. (pp. 33-39)

G. At worst, Mali is already very close to self-sufficiency in cereals production at the Plan's nutritional target level (181 kg of annual consumption per capita). For the moment at least there is some overproduction of rice. The Malian Government appears to be encouraging as well as expecting an increase in per capita rice consumption, displacing coarse cereals. While there are a number of reasons of believing that per capita rice consumption will increase at some rate, rice is more costly than millet, sorghum or maize. Increased use of partial (as opposed to total) irrigation methods for producing rice would help on the cost side but would provide no guarantee of adequate production in drought years. This report analyzes the results of different rates of expansion of rice consumption at the expense of coarse cereals. It does not believe that the high rates projected by the Plan for the period 1980-2000 are realistic. (pp 40-50)

H(1). The adequacy of transport infrastructure varies immensely between regions. Some have excellent primary routes; others have.

inadequate road networks. All suffer from one of the major constraints facing Malian agriculture today -- an inadequate and deteriorating feeder road network. (pp. 51-53)

H(2). Lack of adequate crop storage is commonly cited as a major problem. With regard to cereals, a distinction should be made between on-farm storage and central storage, which is usually government-owned. The former should be encouraged through price incentives or other means in order to reduce costs and risks of loss or spoilage. Existing central storage capacity for cereals is probably adequate but is poorly distributed and managed. There are also problems of storage capacity for rice awaiting milling, unginned and ginned cotton, and cottonseed, (pp. 54-60)

H(3). Low levels of literacy in rural areas has led non-formal education programs to concentrate on functional literacy. Literacy in indigenous languages is taught to adults in some 2,000 functional literacy centers throughout the country. The program appears to have a postive impact on the ability of farmers to learn new techniques, to market their produce, and to manage farm affairs. There are also 46 Rural Animation and Training Centers for farmers (CFARs) whose two-year training program emphasizes military training as well as agriculture and literacy. (pp 61-66)

I. Crop varietal development and testing have high priority in crops research. It is in pearl millet that results so far have been least satisfactory. A program is being undertaken to improve the multiplication and distribution of selected cereal seed. Soils research shows that Malian soils are low to very low in available phosphorous. Nitrogen applied in combination with phosphate fertilizer produces significant yield increases over phosphate alone. Results from research and pilot farmer programs show that there is production technology in Mali that can significantly increase yields of food and cash crops (pp. 67-68)

J. Training programs for senior and middle-level agricultural personnel at the Rural Polytechnical Institute have been expanding rapidly. However, the centers which train junior staff are now capable of supplying only 90 graduates a year against an estimated need of 200 yearly. The quality of training received at all levels raises serious problems for the Operations, which employ the largest number of agricultural staff. Foreign financing available to the Operations allows them to pay bonuses and provide working conditions better than anything available under the Ministry of Rural Development. Rural radio programming is an invaluable aid to extension agents. Many of them appear to spend a disproportionate amount of their time with larger, more well-endowed farmers. (pp. 79-86)

K(1). A state agency known as SCAER distributes farm implements, fertilizer, pesticides and agricultural credit. Ninety percent of its sales and all of its credit allocations are provided through the Operations. SCAER has no direct contact with farmers yet assumes all risk. It has been faced with serious financial problems, aggravated by the subsidization of inputs. (The subsidy on equipment was removed in 1976, while those on fertilizer and pesticides were reduced.) The effect of SCAER's levies on sales of cotton and peanuts is to make poorer farmers pay for a portion of the subsidies that have been given to, and the bad debts of, the richer farmers. Transportation and other problems have led to criticism of SCAER's ability to provide inputs on a timely basis. (pp. 87-92)

K(2). Mali was estimated to have more than half of the plows, about one quarter of the ox-carts, and some 40 percent of the draft animals in all seven of the Sahelian states combined in 1975. Adoption of animal traction has moved rapidly in recent years. The total number of plows and multipurpose toolbars in use is over 100,000, possibly as many as 130,000. About one-fourth of Mali's farmers are equipped with the basic element for modernization. However, in 1976 sharp rises in prices for equipment and draft animals, combined with unchanged producer prices, may slow down the rate of adoption. (pp. 93-97)

K(3). Chemical fertilizer was used almost exclusively on peanuts and cotton prior to 1970. Use on those crops and others increased sharply in that year. By 1975 Mali accounted for 30 percent of the fertilizer nutrients being used in all seven Sahelian countries In 1975-76 single superphosphate was used on approximately one-half of the peanut hectarage in the OACV zone, and use of a cotton mixture was spreading rapidly. At current prices for chemical fertilizers, which are subsidized to a far lesser degree than they were in 1975, their use on millet or sorghum makes sense only if the farmer can expect both to have better than average yield and to sell all of his incremental production at no less than official prices. Use on maize and rice is more promising and is being encouraged by the Operations. (pp. 98-108)

L. Most observers consider that the volume of cereals marketed is in the range between 10 and 20 percent of the harvest. Official purchases by the government agency OPAM vary from 15 to 50 percent of the amount marketed. At the present time OPAM does not have control of the coarse cereals market and is unable to establish the official price of 32 MF/kg. Private traders play several important roles in cereals marketing, entering the market when OPAM is not active. They provide an outlet for farmers who need to sell quickly or those who have more surplus production than they are authorized to sell under the official system. Cotton and peanuts are purchased from producers much more efficiently by mobile buying teams of the respective Operations. Nonetheless for both crops there are problems encountered in transporting purchases to processing centers. There is also a shortage of cotton ginning capacity, and delays are encountered in moving cotton lint into export channels. (pp. 109-121)

Part II: Discussion of Issues

A. Mali is basically in a postion of self-sufficiency in cereals. The inadequacy of the present system to market and distribute cereals

should cause more immediate concern than production capacity. In the context of the Sahel, Mali's ability to respond to export opportunities for cereals is limited more by its ability to export than by its ability to produce. The drought showed that the country needs more flexible ways of handling cereals in order to cope with both good harvests and bad. Constitution of a security stock of no more than 60,000 T of coarse cereals and rice would mitigate the initial effects of renewed drought. Another objective would be to create the capacity to provide sufficient grain to the deficit areas. To accomplish this, the official producer's price should be allowed to follow free-market price fluctuations more closely. The official purchasing system also needs improvement. We suggest that the government leave certain zones to private traders and have the Operations based on cereals (as well as Operation Arachide for maize) buy for the account fo OPAM, being fully compensated for the marketing costs incurred. It is of considerable importance for the government to determine the actual needs of the deficit zones and to study ways in which cereals from the surplus zones can be efficiently shipped to them. (pp. 122-131)

B. The 1976 price increases for agricultural implements and chemical inputs have significantly altered relationships between official product and input prices. Producer prices in Mali are clearly lower than prices in other West African countries. Yet, except for cotton, they are not particularly low vis-a-vis world market prices when transport costs are added to base prices. Current product prices are too low to encourage rapid expansion of animal traction use. Only farmers already equipped have sufficient production capability to earn from agriculture the cash incomes necessary for further investment. (pp. 132-137)

C. There is no indication that the agricultural sector has had typically poor and declining terms of trade with the rest of the economy over the past decade, at least until 1974. When one looks at resource transfers, however, there are indications that the

government's extraction of an "economic surplus" from the primary sector to provide investment funds for industry may have become a heavy burden. If markets and price incentives are available, it appears that a majority of farmers are knowledgeable enough to adopt innovations and new technology rapidly. But problems related to investment in infrastructure -- inadequate rural roads, processing capacity and marketing efficiency -- need to be solved quickly if severe bottlenecks are to be avoided. (pp. 140-147)

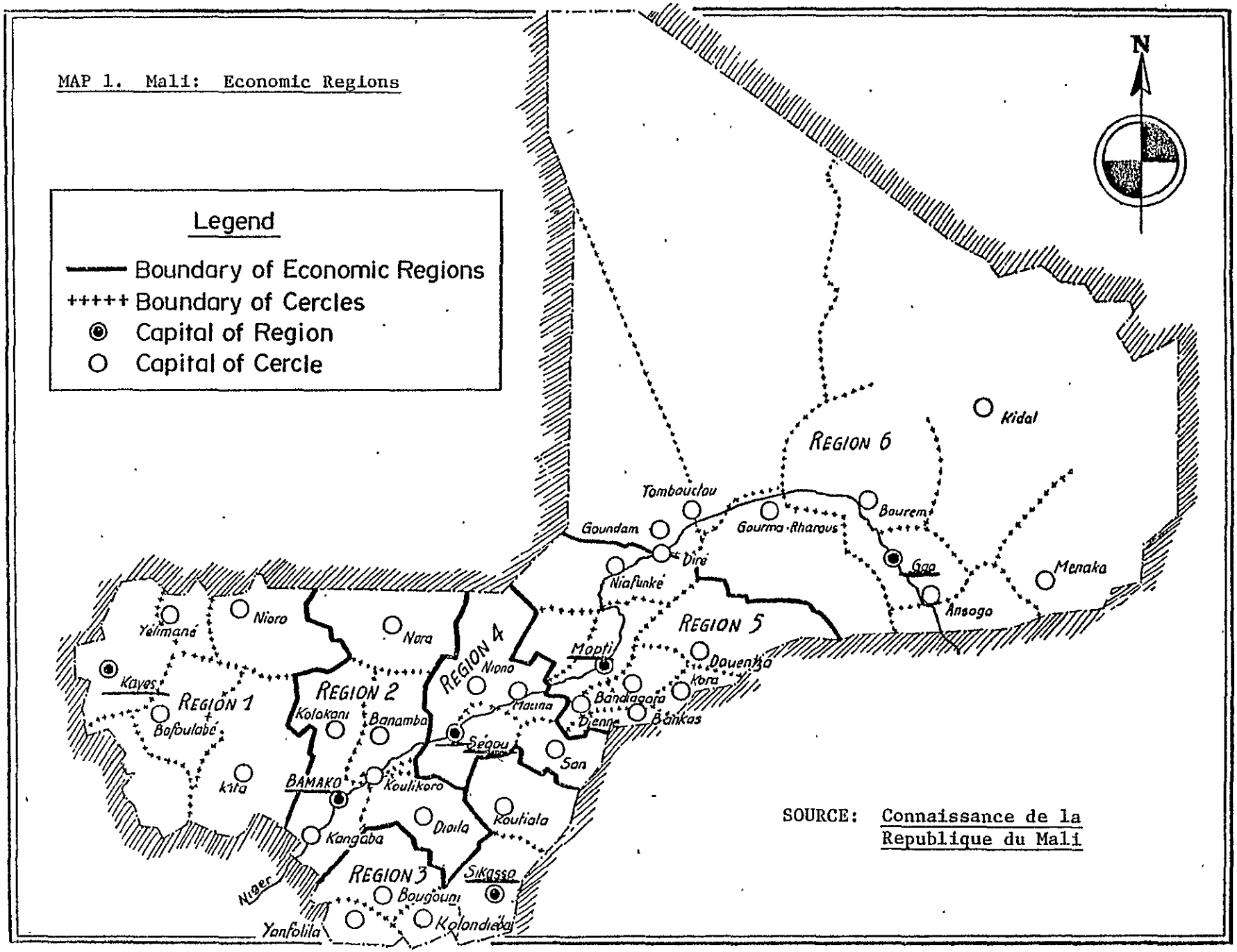
D. There is a particular need for increased research on cultivation techniques, implements and implement use. Serious questions can be raised about the types of mechanical inputs now being extended. Research should include farm management and sociological studies to yield information about productivity under location-specific conditions. Microeconomic research is needed on such things as the price responsiveness of farmers and consumers, on the economic efficiency of private and public spending patterns, and on the economics of grain storage. A prerequisite to useful macroeconomic research is the establishment of good official data series on agricultural resources and their use, production, productivity, prices, commodity flows, and consumption patterns. (pp. 148-155)

E. With regard to export crops, the recent return to higher production and marketing levels for peanuts is in danger of being cut short by a low producer price. Since world market prospects for peanut products are not particularly favorable, a critical look might be taken at the charges and taxes taken out of revenues before the farmer gets his share. Cotton presents a brighter picture. Exports of mangoes and green peppers have made good progress in recent years but remain limited. Dried onions are an important and growing export through private channels. Domestic tobacco production will have difficulty meeting domestic needs, and there is some pessimism about export possibilities. The gap between domestic needs and domestic sugar production promises to grow. Given ambitious plans for growing and refining sugar in Ivory Coast and Upper Volta, Mali may

want to evaluate potential social costs and benefits carefully before embarking on a program of its own. Kenaf fiber grown in Mali is said to be of good quality and might eventually be exported once domestic demand has been satisfied. The government is working on plans for production of forage crops; the importance of moving toward integrated farming operations has been recognized. (pp. 156-174)

F. The philosophy of agricultural extension in Mali, as elsewhere in French-speaking West Africa, tends to make the farmer the object, not the agent of agricultural development. This philosophy justifies and sustains a highly-centralized command-type structure for implementing extension programs. The structure provides inputs to farmers and support to agents but also discourages efforts to adapt extension topics to local exigencies. It is the rare agent who advises farmers how to schedule plowing and planting in accordance with his own situation with regard to crops, available labor and field location. (pp. 175-178)

G. Mali's economic planning and policy-making displays unusually severe inadequacies. For about a decade Mali has faced the same set of economic problems; the list of steps necessary to rehabilitate the economy is the same today as it was in 1969. The country's economic development plans have been too large, as a result of which they tend to lose any priority-setting influence and to lose credibility in the eyes of external donors. Mali's plans also suffer from inadequate project identification and screening. With regard to the 1974-78 Plan, since it was adopted there has been a significant reallocation of planned expenditure away from rural development toward communications and housing. As of the beginning of 1976 financing for only 28 percent of planned rural development investments had been acquired. Finally, there is a real need to strengthen policy analysis. The lack of trained economic analysts is particularly apparent in the agricultural sector. (pp. 179-191)



SOURCE: Connaissance de la Republique du Mali

PART I. DESCRIPTION OF THE AGRICULTURAL SECTOR

A. LAND RESOURCES, LAND USE AND PRODUCTION

Land Resources

About 60 percent of Mali's 1.2 million square kilometers is unsuitable for agricultural use because that portion gets less than 200 millimeters of annual rainfall. Another four percent is committed to non-agricultural uses. More than 95 percent of the remaining 437 square kilometers either is used solely for livestock pasturage or is unused. (Table 1).

This means that only about 1.8 million hectares, merely 1.5 percent of the total land area, is currently devoted to crop production. Of the cultivated land, 61 percent is in the southern part of the country that receives more than 800 millimeters of annual rainfall. Thirty-two percent is in the central part of the country, which receives between 500 and 800 millimeters of rainfall annually. About one-third of this is cropped under full irrigation or under uncontrolled to partially-controlled flood conditions. The remaining cultivated land is found in the Sahel, Lacustre and Sixth Region Zones[1] where rainfall is less than 500 millimeters per year. In these areas farmers often use irrigation or flood-recession techniques along rivers and around lakes or ponds.

From a national perspective, land is not a limiting factor to increased agricultural production. Estimates are that cultivated area could be increased up to ten or more times its current level without major investment in land or water development being required.[2] However, the amount of arable land in some areas is limiting. In the Lacustre and Sixth Region Zones virtually all land suitable for cultivation without elaborate and expensive irrigation development is now in use. More severely restricted is the plateau portion of the Séno-Plateau Dogon Zone. This area has no unused land that could be developed even

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[1] This report uses the concept of eleven rural zones adopted by the 1974-78 Development Plan. See page 37 for a description of the zones.

[2] Robbins and Garvey, Millet and Sorghum Price Policy, April 1972, p. 4.

Table 1. Land Area and Use in Mali, 1971-1972, by Geographic Zone
(1000 km)

Zones	Total Area	Non-agricultural Uses: Deserts, Mountains River Beds	Non-agricultural Uses: National Forests and Parks	Non-agricultural Uses: Townsites, Roads	Non-agricultural Uses: Total	Cultivated Area	Pasture and Unused Ag. Land
1. Sud	96.1	16.1	2.3	0.6	19.0	6.1	71.0
2. Centre and Ouest	129.5	22.2	11.8	0.5	34.5	3:7	91.3
3. MV Niger-Bani	6.5	0.2	0	0.2	0.4	0.9	5.2
4. Delta	24.0	0.5	0	0.4	0.9	1.2	21.9
5. Haute Vallée	13.0	4.0	1.4	0.3	5.7	0.6	6.7
6. Lacustre	134.2	119.0	0.6	0.1	119.7	0.9	13.6
7. Sahel	75.3	0.8	0.6	0.3	1.7	1.7	71.9
8. Office du Niger	0.5	0.1	0	0	0.1	0.4	0
9. Séno-Plateau Dogon	46.5	7.8	12.0	0.2	20.0	2.6	23.9
10. Sixth Region	714.4	583.3	17.5	0.1	600.9	0.4	113.1
Total Mali	1240.0	754.0	46.2	2.7	802.9	18.5	418.6
Relative Importance %	100.0	60.8	3.7	0.2	64.7	1.5	33.8

SOURCE: Rapport Final de la Commision Nationale de Planification de l'Economie Rurale: Pour l'Elaboration du Plan Quinquennal 1974-78 Part I: Situation de L'Economie Rurale Malienne en 1972, p. 26.

if new irrigation resources were made available. As each of these three Zones is relatively densely populated, land limitations have resulted in agricultural labor surpluses.

There is also unused land in the western half of the Mali Sud Zone that could be developed for agricultural production using animal traction but is unlikely to be until the tsetse fly -- which spreads trypanosomiasis resulting in high cattle mortality -- is eradicated and/or sufficient selected animals resistant to the disease, e.g. N'Dama cattle, are made available.

Areas of less than 800 mm/year annual rainfall with no irrigation potential continue to carry a relatively high risk. It is in these so-called Sahelian (300-550mm) and Sahelo-Sudanic (550-800 mm zones)[3] that rainfall distribution through the growing (rainy) season is erratic. Farmers frequently need to replant sorghum and millet several times when rains do not continue. Late plantings run the risk of moisture shortages during the important periods of grain filling and maturing of the crop. In addition, electrical storms may bring good rains to one village and little or none to a nearby village. Effective moisture for plant growth in these areas is greatly reduced by high evapotranspiration and by precipitation run-off.

Nevertheless, for the country as a whole the cultivable land potential cannot be considered to be an important factor limiting agricultural development. There is considerable potential for the development or improvement of portions of an estimated 500,000 hectares that are suitable for irrigation and for which sufficient water is available in the Senegal, Niger and Bani rivers. Irrigation development need not be on a large scale in order for Mali to obtain substantial increases in cultivated area and agricultural production.

Land Use and Production

Table 2 summarizes the evolution of agricultural land use and crop production since 1964/65.

Food grains occupy about 80 percent of the cultivated land in Mali, with the basic upland crops, millet and sorghum, accounting for more

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[3]Definition taken from Mission IRAT, Rapport Synthétique de la Campagne 1975-1976, p. AMS-1.

Table 2. Cultivated Area and Crop Production in Mali, 1964-65 - 1975/76, by Crop
(area in 1000 hectares, production in 1000 tons)

	64/65	65/66	66/67	67/68	68/69	69/70	70/71	71/72	72/73	73/74	74/75	75/76
Millet-sorghum												
Area	859	830	910	1035	932	745	725	1258	900			1220[1]
Production	709	700	737	830	556	603	715	705	624	660	850	865
Maize-Wheat-Fonio												
Area	46	22	31	23	24			100	81			
Production			76	66	66	151	107	102	83	63	100	110
Rice (paddy)												
Area	158	169	169	196	156	132	145	185	131			200
Production	158	162	158	172	135	162	163	195	100	90	215	260
Peanuts (in shell)												
Area	144	122	129	140	129	118	162	174				240
Production	90	75	88	91	102	129	156	152	135	132	188	205
Seed Cotton												
Area	89	76	62	76	91	76	75	79	86	61		100
Production	33	18	28	37	55	46	56	71	72	55	71	103
Other Crops[3]												
Area								55				50
Total Area					1805	1673	1697	1851				1800

[1] Includes Maize and fonio.

[2] Includes cow peas, vegetables, fruit, sugar cane, tea, tobacco, and kenaf.

SOURCES: La Documentation Française, Notes et Etudes Documentaires: Le Mali, No's. 4081-4083, p. 52;
CNPER, Situation de l'Economie Rurale Malienne en 1972, pp. 44, 277, 278;
IMF, Mali, Recent Economic Developments, p. 4;
IER, Rapport de Factibilité de l'OACV, Tome I, pp. 53-59;
Direction Nationale du Plan et de la Statistique, Rapport de l'Enquête Agricole, 1972-1973, pp. 12, 13, 19;
Elliot Berg, The Recent Economic Evolution of the Sahel, p. 15;
Le Moniteur Africain, Oct. 1976, pp. 11-12;
Unpublished data.

than 67 percent. Next in importance after cereals are peanuts and cotton, using 13 percent and 6 percent, respectively, of the total cultivated land. Vegetables, cowpeas and specialty crops are grown on the remaining 2.5 percent.

Although minor fluctuations occurred from year-to-year during the 1960's, the total area cultivated and the distribution among crops apparently changed little. Food grains, grown almost exclusively as a subsistence crop, dominated. The first half of the 1970's has been characterized, however, by a steady increase in the amounts of land in the primary cash crops, cotton and peanuts, and in maize. Rice area may also have increased although this is not clear since often it is only the areas within Operations[4] that are included in statistical summaries. The acreages in speciality crops such as sugar cane, tea, tobacco and kenaf have increased by relatively large percentages. However, these crops still account for less than 3 percent of the total cultivated area.

Except for peanuts and cotton, production of the major crops remained stagnant throughout the 1960's. Both peanut and cotton production increased more or less steadily until the worst drought years, 1972/73 and 1973/74. They have since rebounded with good harvests in both 1974/75 and 1975/76. The latter year's harvest of cotton was 103,000 tons, 30 percent more than the highest previous year.

Since 1970 the other major crops have also increased in production, with 1975/76 -- considered only an average rainfall year -- being the best year recorded for paddy (260,000 tons), maize-wheat-fonio (110,000 tons), and millet-sorghum (865,000 tons). The previous year, 1974/75, was also a good one for each of these crops.

The two most recent years have yielded record or near-record results for all of the major crops with no increase in total cultivated area. While two years of data provide a slim basis for judgment, it appears possible, perhaps even likely, that Mali is close to a discernable take-off in agricultural production. Recent intensification of agricultural extension efforts, adoption of animal traction, and general modernization of methods may well have begun to show results that will have continuing effects. Other factors undoubtedly contributing were the completion of

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[4]The Development Operations are discussed in section I(F), page 33.

several new rice polders in the Ségou and Mopti areas, the increases in official product prices in mid-1974 and farmers' intensification of production efforts in the wake of the drought.

For whatever combination of reasons, the two back-to-back good years have given Malian farmers and government officials breathing space to address the fundamental human resource and structural problems, primarily in the areas of adoption of new technology, input availability, markets and marketing, which remain as obstacles to continued modernization and growth of the sector.

B. WATER RESOURCES AND IRRIGATION SYSTEMS

Background

Mali's long-term strategy to reduce the high vulnerability of the economy to poor rainfall relies heavily on measures to harness water resources. A key element is the construction of large dams in the next few years at Sélingué on the Sankarani River, an affluent of the Niger, and at Manantali on the Bafing, an affluent of the Senegal. It is thought that the Sélingué dam would permit irrigation of about 32,000 new hectares downstream, while Manantali would irrigate almost 45,000 new hectares within Mali.[1] In both cases the irrigated crops would be protected against another drought.

Meanwhile, the 1974-78 Development Plan[2] contains a program for agricultural water development whose immediate objective is to use more modest means to reach self-sufficiency in rice and sugar by 1979 and 1983, respectively. Since the Plan was conceived, however, the recent drought ended, and Mali in fact became self-sufficient in rice ahead of schedule. In 1975-76 the country produced more paddy than it could mill and considerably more than it needed for immediate consumption. To avoid a digression at this point we will defer further exploration of the implications of this development to section II(A), page 122, and restrict the discussion here to a description of the present situation with regard to the use of water resources for crop production.

Existing Types of Irrigation Systems

There are two major systems of irrigation used in Mali. In French, they are described as irrigation totale and irrigation partielle. The former is typical of large-project surface-water systems in that there is a diversion dam or pumping station with a headworks, main canal, and dis-

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[1] Organisation pour le Mise en Valeur du Fleuve Sénégal, Le Programme de l'O.M.V.S., May 1976, p. 20.

[2] Direction Générale du Plan et de la Statistique, Plan Quinquennal de Développement Economique et Social, 1974-1978, hereinafter referred to as the Plan, pp. 82-101.

tribution system. As is the case in most LDC's, the "irrigation totale" system does not usually supply water directly to each farm. Rather, water goes from farm to farm or field to field. The farmer on the outer edge of the system is the last to obtain water during any one application. The "irrigation partielle" system, which is also referred to as "controlled submersion", consists essentially of dikes that provide some control of natural flooding by the major rivers in Mali.

Other methods of irrigation that are found in the country include the use of:

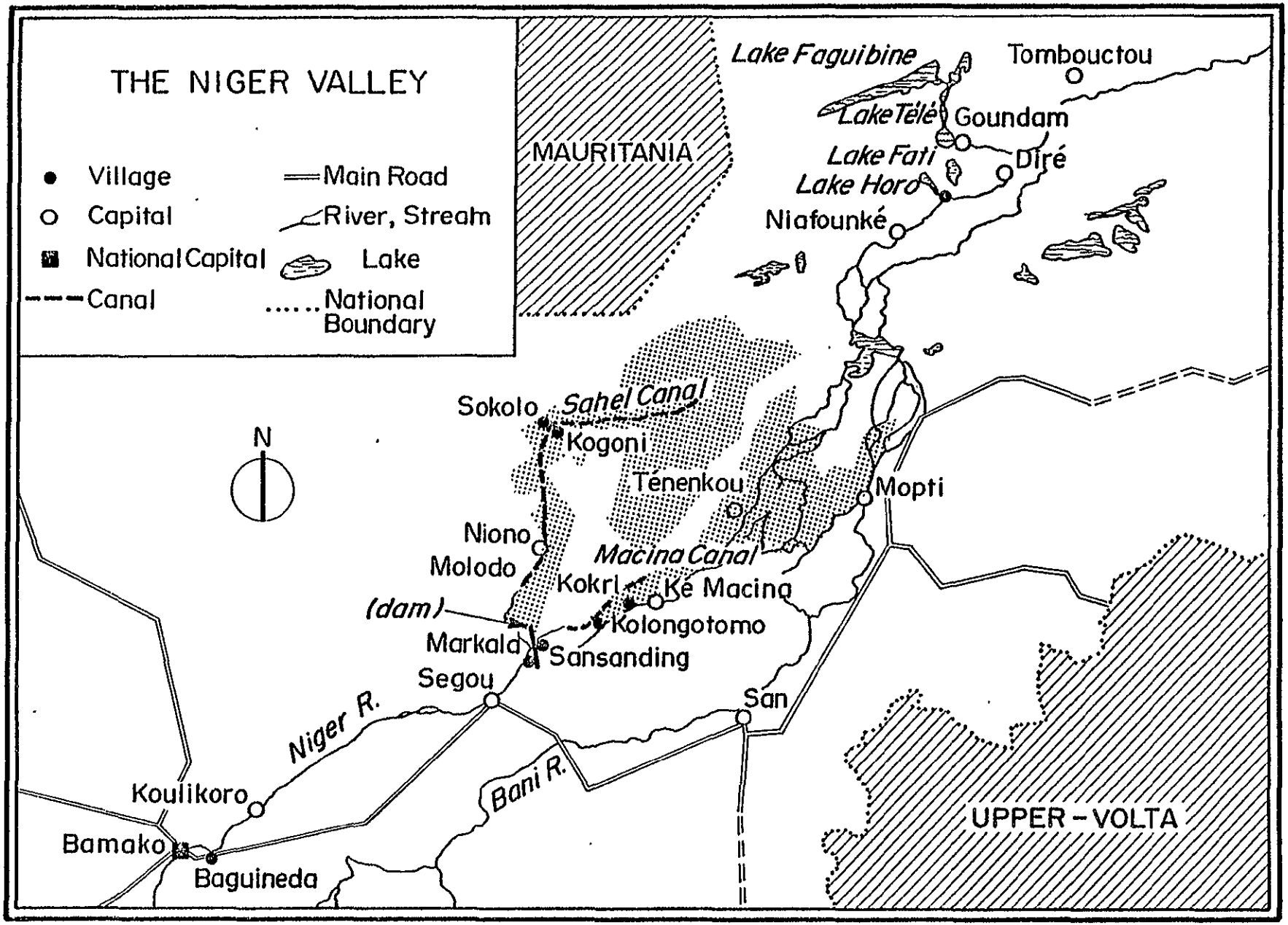
(1) Small motor pumps to draw water from rivers, usually for fruit and vegetable production. Operation Périmètres Irrigués at Kayes employs this method and mounts most of its pumps on floating platforms that rise and fall with the Senegal River;

(2) Natural depressions (bas-fonds) that fill with water in the rainy season, upon which small parcels of rice are grown, usually by women;

(3) Small dams that are built to contain rainfall run-off in areas such as the Dogon hills;

(4) Low-lying areas adjacent to water courses that are flooded for brief periods in the rainy season, permitting crops such as maize and sorghum to be grown with residual moisture after the flood recedes. This type of flood-recession agriculture is found particularly in the First and Sixth Regions.

It is the "total" and "partial" irrigation systems, however, that account for most of the irrigated acreage in Mali. About one-half of the irrigated land that is actually farmed lies in the zone of the Office du Niger, an ambitious and well-known irrigation scheme. Almost 30 percent is devoted to floating rice production under the two rice Operations near Mopti and Ségou. These three major rice production projects contain about four-fifths of the irrigated land in the country.



SOURCE: Actuel Développement, No. 11, Jan.-Feb. 1976
(from I.G.N. carte routière of Mali)

MAP 2

The National Commission for Planning the Rural Economy (CNPER) estimated that in 1972 the total amount of irrigated land actually being farmed was approximately 80,000 hectares, as shown in Table 3.

Table 3. Cropped Areas Under Irrigation in 1972, by Zone and Method

Zone	Total Irrigation		Controlled Submersion	Total	Crops
	Gravity	Small Dams/Streams			
Sud	-	200	1,550	1,750	rice
Centre-Ouest	-	-	500	500	maize & rice
MVNB	-	-	17,000	17,000	rice
Delta	-	-	6,000	6,000	rice
Haute Vallée	2,710[b]	40	850	3,600	fruit, veg., tobacco
Lacustre	-	-	9,380	9,380	rice & sorghum
Office du Niger	39,575	-	-	39,575	rice & sugar cane
Seno-Dogon	-	100	-	100	vegetables
Sixth Region	-	-	3,000	3,000	rice & sorghum[c]
Total	40,425	340	37,280	80,905	

SOURCE: CNPER, Situation de l'Economie Rurale Malienne en 1972, p. 389

[a] See page 37 for description of Zones
[b] includes 1,860 ha irrigated by pumping
[c] flood-recession sorghum

The controlled sumbersion systems of Ségou and Mopti are listed under the Moyenne Vallée (MVNB) and Delta Zones, respectively. With help from the European Development Fund (FED) and the World Bank, their polders, as they are sometimes called, have been expanded from about 23,000 ha in 1972 to

cover some 40,000 in 1975. The function of the system is to permit farmers to plant floating rice in the basins of the Niger and Bani Rivers.

Floating rice has the characteristic of growing at the rate of up to 5 cm per day, provided encroaching flood waters rise no faster than that. A rate of flooding faster than 5 cm per day will cover the rice and cause it to die if it is inundated for too long a period. Floating rice is unable to grow at a fast rate, however, until the root system has fully developed 40 to 50 days after seeding or transplanting. Seeding of floating rice usually cannot begin until mid-June. The Niger River, meanwhile, rises approximately one meter in the month after the flood begins, normally in late July. The diking system is therefore needed to control the rate of in-flow of the flood in order to protect the young seedlings.

Such a partial-control system is at the mercy, however, of the levels to which the river rises. This was clearly illustrated when Operation Ségou harvested only 21 percent of the acreage sown in the drought year of 1972-73 and only 19 percent in 1973-74. It was not until 1974-75, when there was adequate rainfall and the rivers were correspondingly higher, that the newly-created polders were brought into full production. Paddy output increased dramatically, as shown in Table 2.

Potential for Developing Surface Water

Although the potential for retention of surface water has apparently not been investigated to a great extent, the Government of Mali has approved a program of construction of earth-filled dams for ponds or reservoirs in 1976 and 1977. Their successful completion and utilization could be of primary importance to Mali. If these initial ponds can be successfully utilized without excessive evaporation, the idea can be expanded to other areas.

A related possibility is found in the First Region, where the Térékolé River overflows its banks in certain portions during the rainy season. The local population has been attempting to construct dams to hold the flood and distribute it over larger areas. Since the dams are constructed by hand without proper compaction, they have to be rebuilt or repaired every

year. If suitable locations with natural spillways (or spillways that can be developed) can be found for the construction of improved earth-filled dams, reservoirs can be built which will hold water for longer periods and increase the availability of water for crop and livestock use.

Groundwater

During the drought years, ground water aquifers were inadequately replenished and became overexploited. The 1974-78 Plan proposes to counter the lowering of aquifers and provide adequate water for the population by means of a well construction program, with help from US/AID Mali, the World Bank, the European Development Fund (FED), UNDP, France and the Federal Republic of Germany.

The Hydraulic Department of the Malian Ministry of Rural Development operates three well drilling rigs: two provided through UNDP and one provided by US/AID Mali. The Department plans to construct 500 to 600 wells annually. It is expected that only about 60 percent of those will be productive. This is because there is not yet enough ground water information available to assist in locating the most probable sources of ground water.

The African Development Bank is currently sponsoring a project entitled "Mali Ground Water Data Compilation Study" which will be the basis for making the exploration and development of ground water resources more efficient. This project will establish a documentation center and a card index of technical data on existing ground water catchments.

Manpower

The Government of Mali has conferred on the Direction Nationale du Génie Rural in the Ministry of Rural Development responsibility for the development of irrigation and drainage systems. (Figure III, p. 189.)

One of the most critical problems facing the Government in developing its irrigation potential is the shortage of trained staff in Génie Rural. This is true throughout the organization but is particularly true of the Design and Study Section (Bureau d'Etudes). There is enough work in this

division of Génie Rural to keep a much larger staff fully occupied. As a result, their work lacks detail and quality, deficiencies that could be overcome by a larger and better-trained staff. A study of the work-load and the resulting manpower requirements would be most helpful. Requests to donors for training additional staff outside of Mali might also be made. This should not be viewed as a short-term problem. There will be increasing requests for the services of this division.

Génie Rural was equipped with earth-moving equipment in 1963-64 with the assistance of the U.S.S.R. to construct a number of irrigation projects. Unfortunately, difficulties encountered and the absence of independent management caused Génie Rural's activity to diminish considerably. It was only during the struggle against the drought that these activities were resumed.

Currently, Génie Rural's interventions amounting to some 200 million MF per year, are oriented toward the construction of buildings in the Bamako Region, building masonry dams in the Séno-Dogon Zone, and small irrigation improvement in the areas of Kayes and Lake Horo. The organization suffers from a number of handicaps:

(a) Middle management personnel are insufficient in number and qualification while the lower echelon personnel, long unemployed, need to be retrained;

(b) The earthmoving equipment and repair shops are insufficient in quantity;

(c) Top management is not organized to undertake public works contracting.

In 1975, Génie Rural received financing from FED, the World Bank and France for the establishment of an equipment brigade that will be capable of the construction of earth-filled dams and dikes. This will provide a capability in this type of construction that does not presently exist in Mali.

The Equipment Brigade is to be organized for the express purpose of constructing 50 ponds in "1'Espace Pastoral Mopti" project, building irrigation facilities for 1100 hectares in the Sikasso Region, and diking 6000 hectares as an extension to Operation Riz Mopti.

C. FARMER INCOMES AND INCOME DISTRIBUTION

In Mali about 90 percent of the total population lives in rural areas and is supported, partially or totally, by agriculture. The 4.7 million rural residents in 1971 earned about 99 billion Malian Francs or, approximately 64 percent of gross domestic production.[1] Income per capita in agriculture was 19,900 MF (net of taxes), only about one-half of the national average (Table 4). And of this amount more than 60 percent was income in kind, primarily cereals produced for home consumption. Net cash income per capita was only 7,300 MF (roughly $15).

The primary sources of rural incomes were agricultural activities, crop production, livestock and fishing. On a national average these activities provided, respectively 46, 48, and 6 percent of rural income derived from agriculture (Table 5). Agricultural income in 1971 comprised 84 percent of rural non-money income and 76 percent of rural money income. Non-agricultural rural activities, forestry, wild fruit gathering, and handicrafts provided 16 percent of non-money income and 22 percent of money income.

The distribution of incomes among residents of the various agricultural zones in 1971 is shown in the last column of Table 4. Rural incomes were highest in the Delta Zone, followed by the Office du Niger and the Sixth Region Zones. Rural incomes in the Delta Zone were, in fact, twice the per capita income for the whole sector, and roughly equivalent to the national average per capita income.

The relatively higher per capita incomes in the Delta and Sixth Region Zones are probably due to the importance of livestock in their production systems, accounting for 87 percent of total agricultural income in the Sixth Region and 52 percent in the Delta (Table 4). It should be noted, however, that this was the case in 1971, before severe livestock losses occurred as a result of the worst drought years. The Delta also enjoys substantial income from fishing. An explanation of the high per capita income level in the

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[1] CNPER, Situation de L'Economie Rurale Malienne en 1972, p. 10.

TABLE 4. Rural Population and Rural per Capita Incomes in Mali, 1971-1972, by Agricultural Zones

Agricultural Zone	Rural Population (1000 persons)	Non-money Income (1000 MF)			Money Income (1000 MF)			Total Income Net of Taxes (1000 MF)
		Agriculture, Livestock, Fishing	Other[1]	Total	Agriculture, Livestock, Fishing	Other[1]	Total	Total Net of Taxes
Sud	1295	8.8	2.8	11.6	5.0	2.2	7.1	6.3	17.9
Centre-Ouest	997	6.4	2.8	9.2	3.5	2.2	5.7	5.0	14.3
M.V. Niger-Bani	183	9.9	2.8	12.7	8.0	2.2	10.2	9.4	22.2
Delta	297	21.0	0.8	21.8	16.8	2.0	18.8	17.8	39.7
Haute Vallée	156	7.9	2.8	10.8	9.5	2.2	11.7	10.8	21.6
Lacustre	346	13.8	0.3	14.2	6.6	0.8	7.4	6.7	20.8
Sahel	466	10.1	0.7	10.8	5.2	1.7	7.0	6.2	17.1
Office du Niger	42	13.8	0.8	14.5	14.2	1.7	15.9	15.2	29.8
Séno Dogon	503	10.0	2.1	12.1	4.8	1.9	6.7	5.9	18.0
6th Region	432	18.6	0.3	18.9	8.6	0.7	9.4	8.2	27.1
Total[2]	4717	10.6	2.0	12.6	6.2	1.8	8.1	7.3	19.9

[1]Forestry, wild fruits, handicrafts

[2]Averages weighted by rural population

SOURCE: CNPER, Situation de l'Economie Rurale Malienne en 1972, pp. 27, 30, 31.

Table 5. Division of Agricultural Incomes in Mali by Subsector and Agricultural Zone, 1971-1972

Agricultural Zone	% of Money Income			% of Non-money Income			% of Total Income		
	Crops	Livestock	Fishing	Crops	Livestock	Fishing	Crops	Livestock	Fishing
Sud	73	23	4	68	31	1	70	28	2
Centre	38	62	0	68	32	0	61	39	0
Ouest	65	28	7	65	34	1	65	32	3
M.V. Niger-Bani	65	22	13	72	27	1	69	24	7
Delta	8	43	49	38	59	3	25	52	23
Haute Vallée	82	13	15	65	29	6	75	20	5
Lacustre	18	62	20	46	53	1	37	56	7
Sahel	20	77	3	46	53	1	37	62	1
Office du Niger	84	16	0	73	26	1	78	21	1
Séno-Dogon	46	54	0	49	51	0	48	52	0
6th Région	1	94	5	15	84	1	11	87	2
Total[1]	41	40	13	50	49	1	46	48	6

[1]Weighted Average

SOURCE: CNPER, Rapport Final, Situation de l'Economie Rurale Malienne en 1972, p. 29.

Office du Niger is that the residents of the Office are working the most highly developed land in Mali. Also they have assured irrigation, have long been the object of agricultural training and extension efforts, and have a relatively good supply of agricultural implements and other modern inputs.

In the absence of data relating to income distribution among farmers within zones some information can be gleaned from Table 5 with respect to the probable income distributions in the zones where livestock are important income earners. The ownership of livestock appears to be very unevenly distributed among farm families, as shown by the estimates of the Enquête Agricole below.[2]

Table 6. Distribution of Livestock Ownership

	Cattle		Sheep		Goats	
Livestock ownership	% of farms	% of cattle	% of farms	% of sheep	%of farms	% of goats
None	55.2	0	67.2	0	61.0	0
1 - 5 head	24.8	14.6	16.8	16.0	19.2	12.9
6 - 20 head	14.4	34.3	13.1	47.5	15.3	41.4
20 + head	5.6	51.1	2.9	36.5	4.5	45.7

SOURCE: Direction Nationale du Plan de la Statistique, Rapport de l'Enquête Agricole, 1972-1973, p. 27.

Something less than one-half of all farms have any cattle and even lesser percentages have either sheep or goats. More than 80 percent of each type of livestock appear to be in the hands of the few farmer, or herder, families (15 to 20 percent) that own more than five head of one or more types of livestock. Eighty percent of farm families do not have more than five head of any type.

[2] In light of the weaknesses of recent surveys of the Enquête Agricole, these percentages should be treated with caution and taken as indicating orders of magnitude.

The implication of these data is that in the regions where livestock is a major income source, wealth and quite likely income distribution may be very unequal. In the Sixth Region, Sahel and Delta Zones, only about 40 percent of all farms have any cattle.[3] Substantially fewer have sheep or goats. This skewed distribution is particularly disturbing in the Sixth Region and Sahel Zones if income leveling is a goal. Poor land and poor rainfall limit the possibilities of farm families with no or few livestock. They may be unable either to produce enough food for home consumption or to earn income to purchase food in the market. Thus, while the relatively high per capita incomes in the Sixth Region would seem to indicate no need to give priority to increasing incomes there, skewed livestock ownership and lack of earning power clearly leave most of the population in the zone at the low end of the national income scale.

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[3] Rapport de l'Enquête Agricole, 1972-1973, p. 26.

D. MIGRATION AND EMPLOYMENT

Population movement in Mali is extensive and increasing. The existing patterns of migration are of considerable importance in the planning of agricultural development, particularly because migration has a direct effect on the availability of labor in agriculture. Needless to say, data on migration are quite scarce and often inaccurate.

Migration in Mali may be temporary (seasonal) or permanent and have various effects. It may lead to a rapid increase in production and employment and add substantially to the income of the migrants. On the other hand, a rapid influx of migrants may lead to a decline in wages and an increase in unemployment and underemployment. The migration is selective in that a good part of the total migrant population consists of males between the ages of 20 and 40. Their migration often deprives the countryside of a substantial fraction of its most adventurous and skilled manpower.

The reasons behind a decision to migrate are numerous and quite varied. However, we can attempt to isolate several general causes:

(a) The search for sources of income: many young people leave their villages after the harvests and go to urban areas or even neighboring countries (Ivory Coast, Upper Volta) in search of salaried work. In reality, newcomers in the urban market have serious problems finding productive employment -- many of them end up in the traditional service subsector. Even so, with family connections in town and as a result of greater economic activity there, many such migrants may be better off than they were in rural areas. Migrants to rural areas in the Ivory Coast, where the labor shortage is said to be acute, may be luckier still and actually find seasonal employment.

(b) The dispersal of the extended family and the trend toward individualization of agricultural life: Traditional village institutions have been in rapid transition since independence. Many young people leave the village in order to escape the weight of traditions and the power that traditional village institutions hold over their lives.[1] In several villages that we

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[1] One young person told us "In the village I work harder than I do in the Ivory Coast and don't even have 500 Francs for myself. The old people don't give us anything." We also talked to another young man who left his peanut-farming village for another, similar village where he could be more independent.

visited the village leaders were quite upset by this problem and spoke of it with sadness and resignation.

(c) The return to agricultural labor in certain regions: Surplus and unemployed labor may be attracted to areas with profitable agriculture and labor shortages. This migration is often linked to the seasonable character of agricultural activities. (For example, every year there is immigration into the southern zones in order to cultivate and harvest cotton; the large part of these migrants return to their zone of origin after the agricultural season.)

Migration has other various effects on village life. Money is often sent back to the family to pay taxes and buy goods. Migrants often go off to earn a bride price. Agricultural knowledge and often agricultural equipment are brought back into villages.

Level of Agricultural Employment

Unemployment in rural areas varies immensely among Regions and is a function of many factors (the area of cultivable land available for a given population, ecological conditions, type of crops and pattern of cultivation, level of technology, etc.).

The CNPER final report attempted to identify migration patterns and the level of employment by zones. Based on that analysis, we can classify three large groups:[2]

(1) Zones where the active population is a limiting factor, constituting a bottleneck for the development of agriculture. These are the Sahel, Office du Niger[3] and Delta. For certain portions of these areas it may be advisable to encourage immigration and at the same time to promote those animal traction techniques which save manpower.[4] (For other portions

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[2] CNPER, Situation de l'Economie Rurale Malienne en 1972, p. 220.

[3] We were informed by IER that for some time there have been more requests from potential settlers than the Office could accept. In fact the settler population seems to have increased slightly from 42,000 in 1971-72 to 46,000 in 1975-76.

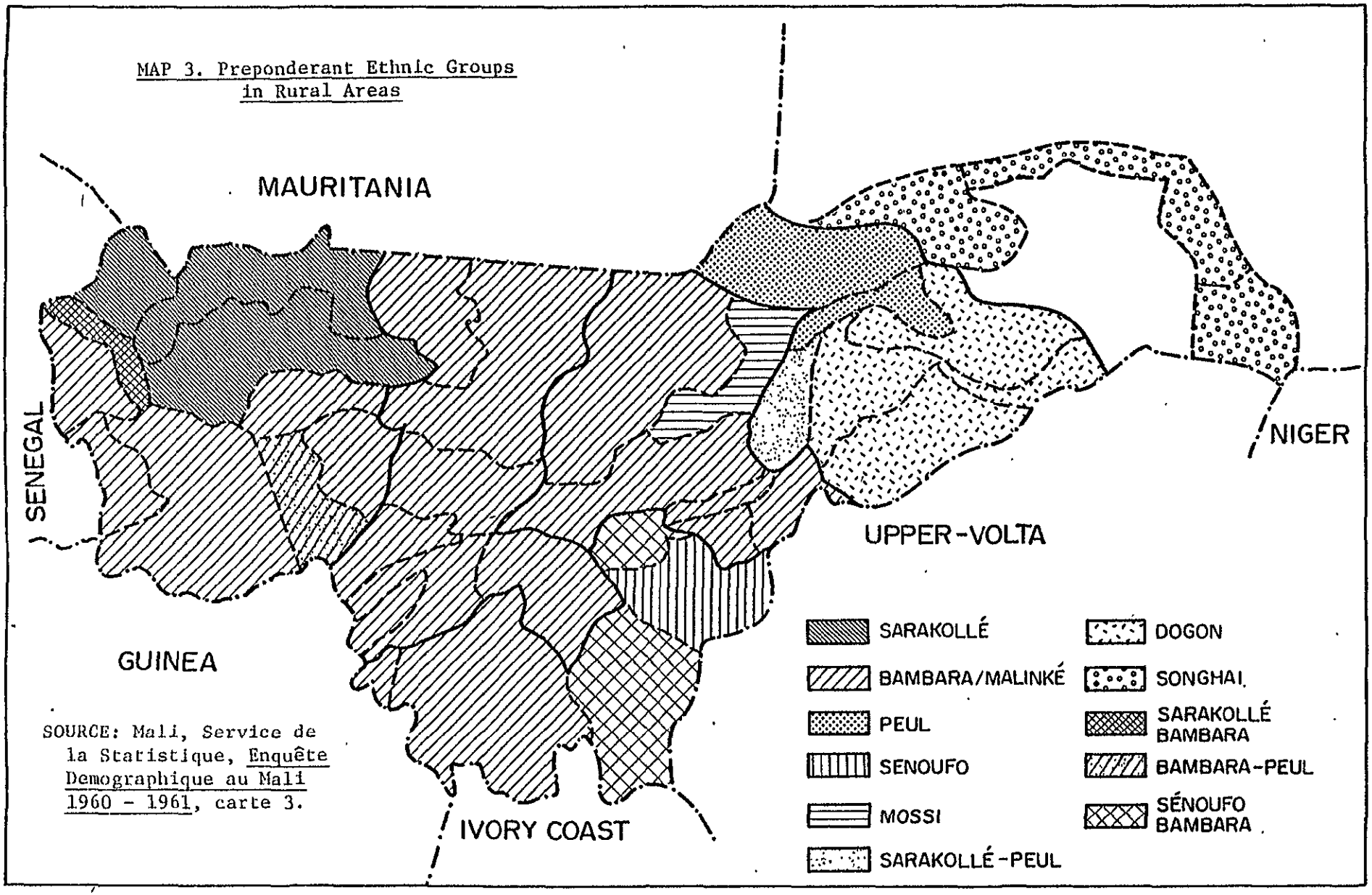
[4] For example, in the peanut-growing zone it has been estimated the farmers using traditional methods devote 194 man-days per crop of peanuts and millet. The introduction of ox-drawn toolbars and seeders can result in a reduction of fifty man-days per crop. A 100-kg ox-drawn cart can produce a further saving of 12 man-days. See Uma Lele, The Design of Rural Development, p.37. Along the same lines, one OACV sector chief told us that he was hoping to compensate for the out-migration of labor by increasing the use of toolbars (multiculteurs).

ecological conditions may make immigration unadvisable, and in the Office du Niger animal traction is already in wide use.)

(2) Zones where there is an equilibrium between active workers and work possibilities. These are the Zones Sud, Moyenne Vallée du Niger et du Bani, Haute Vallée, Sahel, Séno-Dogon, Centre, and Ouest. In these zones one should continue to promote animal traction, consider expanding cultivated areas and explore the potentialities of involving local populations in infrastructure creation during the off-season.

(3) Zones where land is the limiting factor and a major constraint to increasing agricultural production. There is not enough cultivable land for the existing population, resulting in underemployment and unemployment in the region. These zones are Lacustre and the Sixth Region. In these zones there is potential for using manpower in other activities. In the meantime, increased cereal production around the lakes and along the river in these chronically-deficit regions could be encouraged with little or no emphasis on agricultural equipment in order to give work to the local population.

MAP 3. Preponderant Ethnic Groups in Rural Areas



SOURCE: Mali, Service de la Statistique, Enquête Demographique au Mali 1960 - 1961, carte 3.

E. TRADITIONAL PRODUCTION SYSTEMS

In this section traditional production systems are illustrated by means of examples from the Malinké, Bambara and Songhai ethnic groups, three of the largest in Mali. They are concentrated in the western, west-central and eastern regions of the country, respectively.

Land Tenure

Malian systems of land tenure show considerable capacity to adapt to the ecological environment and changing circumstances. The traditional system of land distribution and right of access that evolved in response to a situation of land availability is today in transition as a result of a number of factors.

In Malinké society, for example, traditional property rights consist of the products of such human activity as agriculture, hunting, fishing or war. Elements that constitute the "universe," such as land, cannot be owned in the Western sense of the word but only used (by individuals or collectivities). Thus the concept of ownership extends to the produce of the land but not to the land itself.

The duty of the village chief, assisted by a council of elders, is to settle problems and to coordinate the activities of the heads of extended families. He is usually the intermediary between regional authorities and the inhabitants of the village as well. A point that is important here is that he is the "holder" of village lands and in charge of the distribution of land according to certain rules.[1]

This distribution takes place prior to each cultivation period. All men, regardless of caste or ethnic origin, can claim village land, although generally it is the heads of extended families who make claims. Distributed land is not paid for, except in the case of those from outside the village, who make a symbolic payment.

There is an automatic claim on land by the man who first cleared it

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[1]The term dougou tigi, translated as village chief, literally signifies owner of the land.

or his decendents. Land is considered to be used where there are signs of cultivation. Among the "distributed" lands, the best parcels from the point of view of location or fertility belong to the most influential families who have long-standing claims on them.

Collective Groups

Within the rural community's productive system there are a number of cooperative alliances through which a farmer can increase his food production capability and reduce risk. These alliances primarily provide access to good land, equipment, and most importantly, group labor (particularly during planting, weeding, harvesting, and threshing).

Consanguinal, affinal, age-set, and village or ward-based coalitions meet group labor needs without the outlay of cash. A certain degree of reciprocity is seen as constituting their contractual basis. The reciprocal understanding is that none of the group labor should be used to produce investable and alienable capital. Even if the food which it does produce were eventually sold there would still have been a period between the contribution of labor and the sale during which the contractees could have exercised claims on this produce.

Systems of Cultivation: Millet[2]

The traditional production system in Mali is designed to produce food and cash crops with locally available resources: land, labor, seed and hand tools.

Millet and sorghum are the staples, and are grown in shifting cultivation, without manuring or fertilizing. Intercropping is often practised (cowpeas, greenbeans, potatoes, gourds, etc.). In this system of cultivation, soil nutrient supply gets depleted in approximately 3-8 years. The

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[2]Agricultural conditions and cultural practices vary significantly in Mali. The first discussion is limited to the traditional system of millet cultivation among the Bambara. The date of various activities in the agricultural calendar will of course vary from region to region. The second discussion is a description of Songhai rice cultivation in the Gao region.

crops grown follow a rotation designed not to restore fertility but devised so that crops which make progressively fewer demands on the soil follow one another as soil nutrients become depleted. Thus, sorghum, which is generally grown in the first year, is often followed by millet and fonio. Fertility is restored by letting the land revert to bush fallow for a period that ranges from 3-25 years (depending on the initial fertility of the soil, types of crops cultivated, amount of land available, population pressure, etc.).

The average farm size is about 12 ha. At any given time, approximately 4 ha are cultivated and 8 ha left fallow. The area of a new field put into cultivation is relatively small compared to what it will be in the following years. In the second year the field is enlarged by approximately 30-50 percent of its original size, and each year a little more is added. At the same time, the oldest parts of the field are taken out of cultivation. Thus, each field is left fallow in a gradual fashion. The area cultivated is such that production remains more or less constant.

In a country that is not densely populated, there is still (with the exceptions noted earlier) enough land for the necessary fallow period to be respected. Some shortening of the fallow period, however, has become noticeable. Shifting cultivation has led to a spreading out of cultivated areas, which means that a substantial amount of time and energy must be spent in traveling to and from fields.[3] There is also a resulting fragmentation of the land which can hinder rational cultivation.

Work Methods

A large part of the work effort is for opening new fields or reclaiming fields from bush fallow. This work is the first task of the agricultural season, done without a great deal of haste in April or May. Bushes and small trees are cut down and then burned. Work is done by hand, using a variety of hand tools: a long-handle hoe (restricted to certain ethnic groups) for making hills, shorter hoes for weeding and seeding, clearing instruments,

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[3]Occasionally, villagers in search of new land establish new farming hamlets (hameaux de cultures) to put land far from the village under cultivation.

and scythes.

Tilling and ridging the soil begins in May and early June when the land has absorbed enough water to be cultivated. This work must be done as quickly as possible. The first labor bottleneck is felt during this period, and it limits the amount of land that can be cultivated. As a field is cleared, grasses are removed with the hand hoe (daba) and put to rot in small mounds that are formed, approximately 16,000 to the hectare. Each mound, about 70 cm wide and 30 cm high, receives 4-5 seeds. This method has the advantage of concentrating the most fertile top layer of soil around the roots of the young plants, of protecting the plants from damage during heavy rains, and of giving the plant a deeper soil. Moreover, since the hills only cover about a third of the area of the field, the same plot can be cultivated several years. After seeding, the field must be constantly protected against predators (especially birds). This job is handled by village children.

Weeds grow quicker than the millet; it is usually necessary to weed twice during the season, at precise periods in the plants' growth. Weeding is a long and tedious task, taking 15 to 20 mandays per hectare. It is at this period that the second labor bottleneck begins to be felt.

The Bambara practice of filaké takes place during the second weeding. Filaké means "second made"; it refers to the mound made with the same hoeing strokes used to remove weeds. The newly cut weeds get packed into this second-made mound to compost throughout the dry season until that mound receives the seeds of the next season's millet. In addition to ensuring a fertile mound for the following year's millet, the four-to-five hoe strokes which make a filaké also conserve labor, since no new mounds will have to be made in those precious moments between the first rains and seeding the following year.

Harvest time for millet, depending on the area and variety, is from October to December for early varieties and January - February for late varieties. Millet is hand cut with a knife (kote) and gathered up by women in large baskets. The rate that millet can be cut is approximately 3 ares/hour (3/100 hectare/hr.).

Systems of Cultivation: Rice

Before the drought, livestock raising was the major activity of the Sixth Region, not only for the nomads, but also for the sedentary cultivators in the valley. The drought has, at least temporarily, reversed this relationship between agriculture and herding. Because of decimation of the herd[4] the large majority of the peasants in the valley are putting their energies into the cultivation of rice and flood-recession cereals. The food situation is precarious; with livestock products rare, there has been some malnutrition in the area. (The average consumption of cereals in the Region has been estimated to be about 93 kg per person per year whereas the average ration in rural Mali is considered to be 160 kg of cereals/person/year.[5] The actual levels for both the Sixth Region and rural Mali as a whole may well be higher than these estimates, but the comparison appears valid.)

Two systems of floating rice cultivation are practised along the banks of the Niger River near Gao. Rice is either seeded directly or is transplanted from nurseries. Directly-seeded rice represents 95 percent of the cultivated area.

While some rice planting is done in May and June, most of it waits until August (as there is not sufficient moisture to plant earlier). Dikes are therefore needed to control the rate of inflow of water into the paddies. The lowest areas in the river are seeded first and the highest areas last, in step with the rising of the Niger flood. At the time of the flood the rice must be at least 30-40 cm in height in order to survive. Rice of 30-40 cm in height also has substantial resistance to attack by rice-eating fish.

Transplanted rice (approximately 5%) is sown in nurseries in May and June, and irrigated by hand in the evenings. The nurseries are usually

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[4] In the Arrondissement Haoussa Foulane, animal losses between 1970 and 1974 were estimated at 90 percent for cattle, 23 percent for sheep and goats and 76 percent for donkeys and horses. République du Mali: Ministère de la Production, Etude de Reconnaissance de la Vallée du Niger dans la Région de Gao, 5 volumes. Paris, SATEC, April 1975. (Hereinafter referred to as SATEC.) See vol. 3, p. 17.

[5] CNPER, Situation de l'Economie Rurale Malienne en 1972, p. 41.

located at the edge of a pond (marigot) on communal land or land donated by a member of the village. The rice is transplanted in June and July in the lowest areas of the river bed. It is planted directly into the mud, after preparing the land with the daba. The harvest starts at the end of August and continues until January.

The local rice varieties are well-adapted to local conditions. They are relatively resistant to drought in the growing period before the rising of the flood; the rice then grows at the same rate as the rising water. Weeding problems are solved mainly by the deep water during the flood.

There are, however, a number of constraints.

(a) If the rains are late, planting must be delayed. Consequently, when the flood arrives, the rice may not have had enough time to achieve adequate height and growing vigor in order to survive.

(b) If the flood arrives late (which is more often the case), the rice will suffer from lack of water (i.e. the critical period between seeding and the arrival of the flood will be too long).

(c) Rice is vulnerable to rice-eating fish, especially in early growing periods. This requires that it be protected by dikes in order to limit (or prevent) the entry of fish into the paddies.

(d) Harvesting must be done before the water recedes, which means harvesting from boats.

(e) The productivity of local varieties is limited: in the best conditions, yields rarely surpass 1.5 T/ha. (The mean is 600-700 kg/ha).

As the security of the rice harvest is intimately linked to the vagaries of rainfall and arrival of the flood, agriculture in the Sixth Region, particularly rice cultivation, is a risky undertaking in spite of well-adapted cultivation practices and varieties.

Evolution and Change within the Traditional Society[6]

While Bambara (and also Malinké) social organization may appear to be rather uniform and static, in reality many aspects of it (land tenure systems, work methods, family structure) are in rapid transition. Since social change cannot easily be integrated into traditional Bambara ideology, a generation gap has become visible.

The origin of many changes in Bambara society can be traced to the introduction of cash economy during the last decades of the colonial era.[7] For the first time in Bambara history wealth could be accumulated; in the traditional millet economy accumulation had been restricted by storage problems. With the introduction of money, individual wealth was possible; kerosene lamps, plows, bicycles, cotton textiles, transitor radios, corrugated iron, buckets, and knives became more and more visible parts of village life. In the meantime younger members of the community increasingly recognized that having and controlling their own resources was desirable and that there was a direct relation between agricultural work and accumulation. For them, agriculture lost much of its sacred, collective character.

Villages where the "generation gap" is more evident are found, as one would expect, in those areas of Mali that lie along the major arteries of commerce. These areas have a relatively greater proportion of land devoted to cash crops and are experiencing increasing population pressure on the land. In these commercialized villages, the major constraint on production is land availability, rather than labor availability. In such a situation it becomes advantageous to intensify and individualize agricultural production.

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[6] Much of the information and observations in this section are based on the field work of John Lewis and on a 1973-74 survey organized by Hans van de Belt on social change among the Bambara. See H. Van de Belt, "Agricultural Innovation and Village Structure: A Case Study among the Bambara of Koulikoro, Mali", Katibougou, Institut Polytechnique Rurale, mimeo.

[7] This is not to say that in the pre-colonial and early colonial days there was no trade; on the contrary there were some highly developed exchange systems involving salt, kola nuts, dried fish, guns, slaves, and gold. But these articles and the money system were rather superficial to Bambara village economy, none (except salt) being indispensable to the village. See Van de Belt, op.cit.

This development can be illustrated by the creation of "secret" individual fields. Without the authorization of the head of the extended family or the village chief, young men began to farm their own fields before or after working on those of the extended families. Soon individual fields for the younger members of extended families became accepted and even institutionalized, particular days (usually Tuesday and Friday) being reserved for work on them.

The proliferation of these individual fields in the more commercial areas, by providing a greater opportunity for a youth to earn his own cash, enables him to sever many of the communal bonds existing in more remote villages. If a youth branches out on his own into cash-producing enterprises, his elders may object in principle, but the family economy does not suffer as it would in more isolated areas where lack of labor during key periods of the agricultural cycle (mainly planting and weeding) is a serious production constraint.

Another major transformation in Bambara society that coincides with the increasing tendency towards individualization of land tenure is the breaking up of the extended family. In the extended family economic competion is discouraged; all family yields become collective property and are given to the head of the family. This authority system is increasingly being eroded. Many young people migrate so as to be more independent (i.e., so as not to turn over everything earned to the head of the extended family).

In addition, as brideprice is no longer paid in cattle but in cash, it has become more and more common for the young man himself to contribute to, or even to pay entirely, the brideprice payment, instead of payment by the head of the extended family. This of course means that, for this very important function, the young man is no longer dependent on, or indebted to, his family. The surplus of his agricultural work, in these conditions, is no longer shared with (or appropriated by) the family.

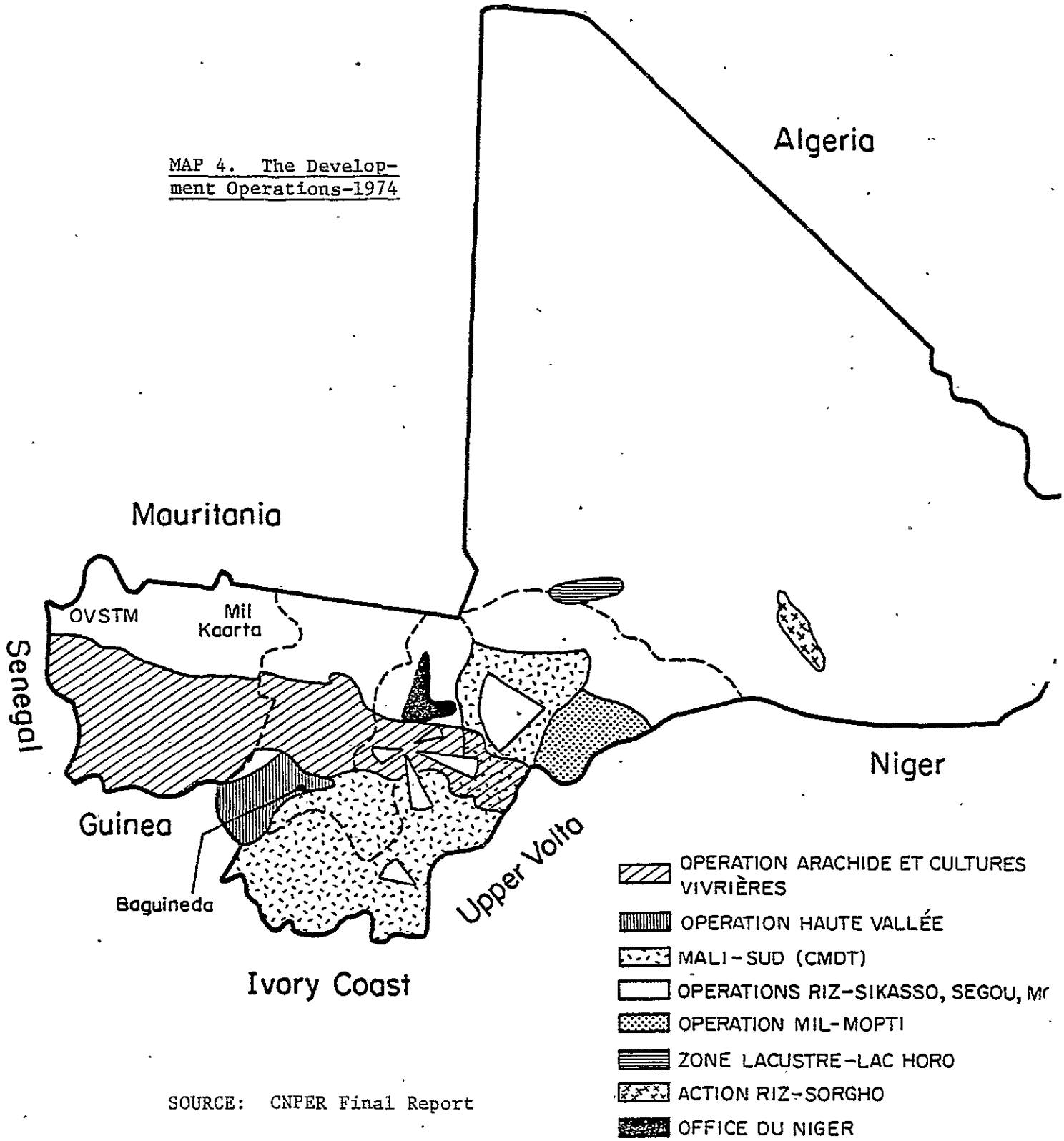
In this evolving social situation, communal organization becomes more and more difficult. The farmer no longer has time to spare during the critical periods of the agricultural cycle. If he spends it on communal

work, he diminishes his cash income. Further, as the number of autonomous agricultural units has increased, organization of working parties has become more complicated.

It would be worthwhile to analyze the effect of various development programs on this changing social and institutional environment. Some programs make little or no demand on farmers' cash resources: for example, timely seeding, row seeding, adequate plant population, and even the introduction of selected food crop seeds. Improvements which require the use of fertilizers and animal traction equipment represent a more significant departure from the traditional production system because they require monetary outlays. Those heads of family who opt for the accumulation of some capital under these circumstances rather than relying on the traditional communal production system usually attempt to restrain the range of the family's reciprocal relationships. This often entails moving to another village to attain the more flexible role of a "stranger".

In concluding this section it is important to point out that most village production systems among the Bambara rely on cooperative labor under conditions of capital shortage. Change is occurring, as we have emphasized, but even as land becomes scarcer in certain areas and as more land everywhere becomes permanently cultivated and individually owned, the cooperative production system continues to play an extremely important role. Rural development programs need to take into consideration the part that kinship, age-set and other coalitions play in maximizing production of food crops under the constraints faced by most farm units.

MAP 4. The Development Operations-1974



SOURCE: CNPER Final Report

F. THE DEVELOPMENT OPERATIONS

A recent report of the UN Food and Agriculture Organization (FAO) on agricultural development in the Sahelian countries points out that the governments of these states were faced in the 1960s with two alternative paths toward the goal of agricultural and rural development.

> To make available to the whole rural population an extensive system of services, which would result in a slow rate of growth in total production and general living standards, or:
>
> To adopt an intensive system of services centered on the priority promotion of export crops in a few regions considered favorable, which would contribute to a rapid growth of these export crops and of the zones and populations which would produce them.[1]

Mali in essence chose the second alternative in the latter part of the 1960s when it began to extablish "Operations", or regional agricultural development projects. The first one, located in the upper valley of the Niger River, was supposed to take an integrated approach to the development of that relatively fertile area. This was changed, however, in favor of emphasis on the marketing and production of a single crop--tobacco. The other Operations that followed took the same orientation; the most important and most successful were those that concentrated on peanuts and cotton: Operations Arachide and Coton (CMDT), respectively.

The Government's policy now, however, is to go back to the idea of an integrated approach. Each operation is to become a rural development effort based on agriculture but also concerned with such things as farm-to-market roads, functional literacy, village water supply, and human and animal health. At the same time there is to be emphasis on crops other than the ones of original focus. To demonstrate this change, Operation Arachide changed its name to Operation Arachide et Cultures Vivrières (OACV) and the World Bank, which agreed in July 1974 to fund OACV's new activities, terms the entire effort an "integrated rural development project." Mali

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[1] FAO, "Prospective Study for Agricultural Development of Countries in the Sahelian Zone (1975-1990): Summary and Conclusions", Provisional, Rome 1976, p. 16.

Sud, the cotton Operation, is undergoing a similar transformation, also with World Bank assistance.

In each of these Operations, which have concentrated the efforts of their personnel so successfully on the production and marketing of their crop, it still remains to be seen how well the new emphasis on an integrated approach will work. There is no question that OACV extension personnel, for example, are working more on cereals, but when the marketing campaign begins their performance may still be judged largely on the volume of peanuts purchased in their area.

Table 7 lists the existing agricultural Operations and their smaller cousins, called "Actions." It does not include those that are non-agricultural or functional such as Operation Puits (water wells) and Operation Protection des Semences et Recoltes (seed and crop protection), respectively. Crops of primary emphasis are underlined.

The Operations have largely supplanted the organization of agricultural services inherited from the colonial period. The old system, financed through the national budget, followed the government's administrative hierarchy. It can also be said that the Operations have generally improved the delivery of agricultural services. Farmers can clearly benefit by "participating" in an Operation.[2] One of the main advantages of participating is the ability to obtain farm implements and fertilizer on credit through the intermediary of the Operation. Credit terms for farmers participating in Operations have eased as subsidies on farm implements have been progressively removed, but farmers in areas outside of the Operations have not benefitted in similar fashion and must now pay very large amounts in cash to buy implements. There are other important advantages as well. One of them is the assurance of a relatively convenient market at a fixed (though perhaps low) price for a particular cash crop. Another is the availability of selected seed and fungicides. Still another is greater density and mobility of extension agents.

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[2]Given the different extension reporting systems among the Operations, the overlap in areas covered by the Operations and by Ministry of Rural Development, there is no reasonable way at this time to assess the number of farmers "participating" in the Operations. At best, given geographical coverage of the Operations, we assume that a majority of Malian farmers participate or are affected in some way by at least one of the Operations.

Table 7. Agricultural Development Operations and Actions

Operation	Crops	Source of Financing
Arachides et Cultures Vivrières (OACV)	Peanuts, maize, millet and sorghum	IBRD, FAC
Baguineda	Millet, sorghum, maize, rice, green peppers, tomatoes, onions, other vegetables and fruit	FAC
Haute Vallée	Rice, millet, sorghum, maize, vegetables, forage tobacco	US/AID (probable) FED
Lac Horo	Millet, sorghum, rice, wheat, cowpeas, forage, watermelon, sweet potatoes	(studies financed by FAC)
Mali Sud	Cotton, kenaf, rice, maize, millet and sorghum	IBRD, FAC, FED
Mil Mopti	Millet, sorghum, vegetables	US/AID, West Germany
Mil Kaarta	Millet, sorghum, maize, Peanuts, livestock	Canada
Office du Niger	Rice, sugarcane	China
Riz Mopti	Rice	IBRD
Riz Ségou	Rice	FED
Vallée du Sénégal - Térékolé - Magui	Sorghum, maize, vegetables	(studies financed by West Germany)
Action Blé Diré	Wheat	FAC, US/AID (probable)
Action Riz - Sorgho	Rice, sorghum	US/AID

The Operations approach changed the functioning of the agricultural services system in two important respects. First, the Operations "are provided with financial and administrative autonomy in order to coordinate and utilize rationally all the means necessary to execute rural development programs."[3] Financial autonomy permits Operations to obtain funding directly from foreign donors. In addition, some receive Malian revenue, not through the national budget, but through ad valorem taxes collected at the time a cash crop is sold for export or processing. The 1975 national budget indicates that OACV, CMDT, and Opération Haute Vallée all appear to operate without direct budget funding. Other Operations, notably Mil Mopti and Riz Mopti, require government counterpart funds.

Some Operations are not yet supported by an outside donor but expect or hope to be. Canada has agreed in principle to provide funds for Operation Mil Kaarta but had not done so by June 1976. Opération Vallée du Sénégal - Térékolé - Magui (OVSTM) exists on paper but has no sponsor. Its director wears two other hats at the same time. For now, the Operation is limited to a handful of extension personnel (10 for 70,000 people in the Yelimané Cercle) who have virtually no equipment at their disposal. In reality, the OVSTM zone, with the exception of some irrigated perimeters along the Senegal River, is "outside" the Operations system.

A second major change from the old system involves structure. Instead of following administrative boundaries, the Operations seek to define the limits of the field-level units by agricultural criteria as well as by the feasibility of providing extension services. Thus, a "region" within CMDT may overlap parts of two or three administrative Regions: a "sector" may cut across more than one cercle and a rural expansion zone (ZER) or casier may cover more than one arrondissement in an effort to unify extension activities in homogenous agricultural areas.

The areas covered by the existing Operations correspond in rough fashion with the eleven rural zones that were adopted by the 1974-78 Plan. In some cases, Operations cover more than one zone and in others there is more than one Operation in a zone. But the point is the same. The country has been divided up into rural zones that are oriented toward production of a particular crop or that use a particular agricultural system or that are defined by certain natural characteristics.

The eleven rural Zones and the Operations that they contain are as follows.

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[3]Article 2 of Ordonnance No. 22 of the Military Committee for National Liberation, March 24,1972.

Table 8. Rural Zones and Corresponding Operations

Rural Zone	Description	Rural Population[a]	Operation(s)
Sud	limited on the south by frontiers; on the north by a line joining Yanfolila Banguineda, Ségou, San and Tominian.	1,295,000	Cotton (CMDT)
Haute Vallée	limited on the south by Zone Sud; on the north by the Manding hills; covers both banks of the Niger between the Sélingué dam site and Kouli-koro; includes Bamako market gardens and the Baguineda Farm.	156,000	Haute Vallée Baguineda
Ouest	limited on the west by frontiers; on the south by Haute Vallée; on the north by Sahel; on the east by the 4th Region (Ségou).	627,000	OACV; Périmètres Irrigués
Moyenne Vallée du Niger et du Bani (MVNB)	all irrigable land along the rivers in the 4th Region, except for the Office du Niger.	183,000	Riz Ségou
Office du Niger	Office du Niger	42,000	Office du Niger
Sahel	northern parts of the 1st, 2nd, and 4th Regions (cercles of Yélimané, Nioro, most of Nara, and northern parts of cercles of Kayes, Bafoulabé and Niono).	466,000	Mil Kaarta; Vallée du Sénégal - Térékolé - Magui (OVSTM)
Centre	remainder of the 4th region.	325,000	OACV
Delta	Cercles of Mopti, Djenné and Ténenkou	297,000	Riz Mopti
Séno-Dogon	Cercles of Koro, Bankass and Bandiagara	503,000	Mil Mopti
Lacustre	Cercles of Niafunké, Diré and Goundam	346,000	Lac Horo
6th Region	6th Region less Cercles of Diré and Goundam	423,000	Action Riz-Sorgho
		4,663,000	

SOURCE: Plan, p. 40

[a]1972 estimate

The trend has thus been toward the concept of the Operation as an agency responsible for an increasing number of development activities in its zone. Our conversations with officials of various Operations tended to confirm this trend. For example, OACV now has a livestock sub-project that has experimented with farm feeding of cattle for market. When offered financial and technical help by the Malian cattle and meat-marketing board (OMBEVI), OACV agreed but insisted that it maintain full control over the experiment. As it was explained to us, OACV wanted to pick the experimental farmers itself and wanted to ensure that no outside extension agents gave advice, even in the field of animal husbandry, that might contradict what OACV agents were saying.

Officials of one Operation pointed out to our mission that their organization continued to co-exist at the sector level with agents of the livestock and forestry services (who come under the aegis of the same ministry) but who seemed to be working in parallel tracks with little coordination of effort. The agents that we talked to seemed to think that it would be logical for their Operation to take over the functions of some of the other services in the zone.

Other observers do not necessarily agree. They see the Operations as having three roles: (a) to educate the farmer, (b) to put at his disposition the means that he requires, and (c) to provide him technical advice. These observers believe that other branches of the ministry have responsibilities of a different character that should not be subsumed under those of an Operation, such as the policing activity required to protect forestry resources. They would prefer to see the Operations evolve in ways that would make them more flexible and less governmental[4] rather than toward the creation of zone chiefs responsible for all activities related to development. Some feel that Mali does not yet have either the governmental structure or enough trained, experienced personnel to make such decentralization of authority work.

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[4]OACV requested the Government to give it corporate status (la personnalité juridique) so that it may obtain direct bank financing for its marketing operations. OACV, Compte Rendu de la Campagne Agricole 1974-1975, p. 85.

Nonetheless, the logic of the present trend is leading toward the concept that there are eleven rural development zones in Mali, none corresponding to an administrative region, and that all rural development efforts in each could logically be directed by a single organization. The Operations, increasingly responsible for development in a variety of domains, may increasingly seek authority to go with responsibility.

Most of the problems surrounding the Operations reflect the growing pains of a new structure. The managerial and financial autonomy of the Operations, which is the principle reason for their successes to date and holds much of their promise for the future, is also the main source of their problems. Managerially, most of the Operations need considerable assistance. As the Minister of Rural Development recently noted, all the Operations need to improve their management and administrative capabilities at all levels. Secondly, substantial amounts of foreign financing permit the Operations to offer financial inducements (production bonuses) and attractive professional opportunities that draw talent away from the Ministry of Rural Development. One result is that the Ministry has found it increasingly difficult to coordinate and supervise effectively the activities of the Operations.

The danger may be that as the Operations gain more flexibility, more responsibility, more authority, it will become even more difficult to impose some form of effective coordination and keep them on parallel tracks. The Ministry today simply does not have the staff necessary to keep its top officials informed of what is happening in the various Operations. There is no one place in the Ministry where comparable information is available on each of the Operations. Though their mandates are becoming more similar with the move to integration, the Operations run the risk of taking markedly different approaches, encouraged by the different requirements of their foreign benefactors.

Note: Readers interested in a more detailed description of how Operations function will find it in Appendix B.

G. CEREALS: PROJECTED NEEDS AND PRODUCTION LEVELS

The 1974-78 Plan set a nutritional target of 181 kg of cereals to be consumed per person per year by 1978-79. This level of nutritional self-sufficiency is based on the norms of the FAO, rather than on any per capita levels of consumption that Malians may have attained in years of abundant supply. In the past actual per capita consumption of cereals has been closer to 165 kg, with some zones consuming more and others less.[1]

If we use the figure of 180 kg as a standard against which to measure production estimates, a population estimated to be 6.0 million in 1976 would require 1,080 thousand metric tons of cereals to attain self-sufficiency. With current consumption patterns, the level of production of coarse cereals (millet, sorghum and maize) required for final consumption is 160 kg per capita, or 960 thousand tons in total.[2] Rice production of 20 kg per capita (equal to 31 kg of paddy) or a total of 120 thousand tons of rice (184 thousand tons of paddy) is also required. Adding to these coarse grain and rice needs the somewhat arbitrary figure of 20 percent for seed, losses, exports, and reserve stocks,[3] the production requirement for nutritional self-sufficiency in 1976 would have been:

Millet, sorghum and maize:	960 + 192 =	1,152 thousand tons
Rice:	120 + 24 =	144 thousand tons
		1,296 thousand tons

Comparison of these nominal production requirements with the cereal production estimates for the 1975-76 season reveals that, at worst, Mali is already very close to nutritional self-sufficiency in

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[1] Plan, p. 42.

[2] CNPER, Situation de l'Economie Rurale Malienne en 1972, p. 361.

[3] The Plan uses 10 percent of national needs as the amount that should be stored annually: 8 percent at the farm level and 2 percent by the government. The 10 percent figure is based on the pessimistic assumption that until the year 2000, inadequate rainfall will cause a cereals deficit equal to one-half of the country's needs one year in every five. Plan, p. 43.

cereals. In June 1976 the estimate of 1975-76 production of millet, sorghum and maize was 975 thousand tons. At the same time, paddy production was estimated to have been 260 thousand tons, or 169 thousand tons of rice. (Since the completion of field work for this report, these estimates have reportedly been revised upward.) Thus, a maximum deficit of 177 thousand tons between nominal requirements and estimated production of coarse cereals is partially offset by a surplus of at least 25 thousand tons of rice. A net deficit of 152 thousand tons for all cereals remains. However, as both requirements and production estimates are rough and subject to large errors, the apparent deficit may be purely illusory. The most convincing indication that Mali is actually self-sufficient is given by the depression in millet and sorghum prices throughout the first half of 1976. Free market prices for these cereals have been from 15 to 30 percent below official prices in most markets in all the major producing areas. Also, we were told by OPAM officials that in June 1976 there were up to 20,000 tons of rice and 50,000 tons of paddy in surplus of domestic needs which they would like to export if markets could be found.

Rice Consumption

Although it is estimated that per capita consumption of rice has remained relatively constant at about 20 kg over the past 15 years, the Plan projected a rapid increase between 1980 and the year 2000. The Plan's projection of a change in the ratio of coarse-cereals to rice consumption from 153/28 in 1978-79 to 105/92 in 2000 is a considerably toned-down version of the CNPER's projection of 70/130 by the end of the century. The CNPER report stated that it was both inevitable and economically necessary for rice to be substituted for coarse cereals in the Malian diet. The economic necessity arises from the report's contention that agronomic research will permit intensification of rice production, presumably lowering costs, whereas there is no such prospect for millet and sorghum.[4]

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[4]Plan, pp. 42-3; CNPER, Situation de l'Economie Rurale Malienne en 1972, p. 335.

There are in fact a number of reasons, enumerated below, for believing that per capita rice consumption will increase at some rate and that per capita consumption of coarse cereals will begin to decline after some nutritional standard has been reached. We use for this purpose an annual consumption figure of 180 kg of cereals per head.

Under present circumstances the crucial factor that works against increased per capita rice consumption is price. The real incomes of those in a position to purchase rice -- which means the population in urban areas -- must rise for there to be increased consumption. The FAO has estimated that the income elasticity of the demand for rice is 0.5, whereas that for millet and sorghum is only 0.2.[5] Within a certain range, increases in real income would tend to result in proportionally more rice in the consumption mix of cereals. It is possible, of course, that the real income of the urban population may not rise at all in the next several years, but for our purposes we have chosen to assume that it will and that there will be an increase in rice consumption by townspeople and in autoconsumption by the rural population as more rice is cultivated. We do not agree with the Plan's assumption that rural incomes will rise to such an extent that by the year 2000 rural people will no longer consider rice a luxury and consume it the way townspeople do today.

The Malian government appears to be encouraging as well as expecting an increase in per capita rice consumption. There are at least two reasons for this. First, since rice is grown principally in a limited number of locations and since it must be milled, government control is easier. Second, using total irrigation methods, the country's production of rice can be made largely independent of the vagaries of rainfall. This was demonstrated during the recent drought by the relative constancy of rice production levels in the Office du Niger. With the expected construction of the Selingué and

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[5] FAO, op. cit., Volume I: Rapport Principal (in French) p. 74.

Manantali dams, additional rice-producing areas will be counted on to produce regardless of climatic conditions.

This is all very well, but the dilemma for the Malian government is the fact that total irrigation methods are rather more expensive than partial irrigation methods, and if rice becomes even more expensive relative to coarse cereals, it will be consumed less rather than more, other things being equal. The government does set the price to the consumer and thus has the power to favor rice over coarse cereals, at least on the official market, but unless it wants to get into the undesirable position of subsidizing rice consumption, increased costs will have to be passed on to consumers. Increased use of partial irrigation methods would help on the cost side but would provide no guarantee of production in drought years. The vulnerability of partial irrigation to climatic conditions was also demonstrated during the drought, when for two years only about 20 percent of the rice land of Operation Riz Ségou received adequate flooding.

In light of the above, we agree with those observers who maintain that under the present set of circumstances more rice is being produced than Mali can consume or export. There may be some overproduction for the next three or four years, but by about 1980 demand should catch up with supply and expanded capacity for rice production will begin to be needed. There is no reason to expect a rapid increase in demand thereafter. Luckily, this situation does provide Mali with some breathing space.

Projected Cereals Consumption Needs

We have made projections of cereals consumption needs to 1980, 1985, 1990 and 2000 on the basis of three hypotheses with respect to cereals consumption per capita by type of cereal. The results are shown in Table 9. The hypotheses are:

> Hypothesis 1. Rice consumption per capita will increase by two percent per year from 1976 to 2000. A commensurate reduction in per capita consumption of coarse cereals will occur.

Table 9. Projections of Populations, Per Capita Cereals Consumption, and Total Cereals Consumption to the Year 2000

	Hypotheses[1]	Year				
		1976	1980	1985	1990	2000
Population (millions)[2]	H_1, H_2, H_3	6.0	6.5	7.4	8.4	11.3
Consumption Per Capita (kg)						
Rice[3]	H_1	20	21.6	23.9	26.4	32.2
	H_2	20	23.4	28.5	34.6	51.3
	H_3	20	27.2	40.0	58.7	126.8
Coarse Cereals[4]	H_1	160	158.4	156.1	153.6	147.8
	H_2	160	158.6	151.5	145.4	128.7
	H_3	160	152.8	140.0	121.3	53.2
Total Consumption (1000 Tons)						
Rice[3]	H_1	120	140	177	222	364
	H_2	120	152	211	291	580
	H_3	120	177	296	493	1433
Coarse Cereals[4]	H_1	960	1030	1155	1290	1670
	H_2	960	1018	1121	1221	1454
	H_3	960	993	1036	1019	601
All Cereals	H_1, H_2, H_3	1080	1170	1332	1512	2034

[1] Rice consumption per capita is assumed to increase by 2, 4, and 8 percent per year for H_1, H_2 and H_3, respectively.

[2] Population growth rates of 2.2 percent per year from 1976 to 1980, 2.5 percent per year from 1980 to 1990, and 3.0 percent from 1990 to 2000 are assumed for all hypotheses.

Hypothesis 2. Rice consumption per capita will increase by four percent per year, replacing an equivalent amount of coarse cereals.

Hypothesis 3. Rice consumption per capita will increse by eight percent per year, replacing an equivalent amount of coarse cereals.

For each hypothesis the per capita consumption level of all cereals is held constant at 180 kilograms. Also, for each hypothesis the population growth rates by period are assumed to be the same: 2.2 percent per year to 1980; 2.5 percent per year from 1980 to 1990 and 3.0 percent per year from 1990 to 2000.[6] The 1976 base population is estimated as 6.0 million persons.

As all projections, the hypotheses for which the effects are traced in Table 6 merely reflect expectations about the future. Hypotheses 1 and 3 can perhaps be considered the outside bounds of reasonable expectation about changes in the ratio of rice to coarse cereals in the Malian diet as other social and economic factors change.[7]

Among the factors or considerations that form a basis for arguing that rice will become a relatively more important consumption good are:

(1) There is expected to be increased consumption by rice producers, independent of their income, as rice-growing areas expand.

(2) Rice is considered to be a prestigious and preferred cereal throughout West Africa.

(3) Increasing real per capita incomes will enable more people to choose to eat rice more often.

(4) Increased cash incomes in the hands of farmers producing export crops (cotton and peanuts) together with some shifting of their land and labor from food production to export crop production will

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[6]The population projection is our own, and is based on the expectation that the rate of population growth will increase as rising real incomes lead to improved standards for nutrition and public health.

[7]Which projection is most realistic is left to the reader's judgment. We prefer the middle road, H_2, primarily because it recognizes, somewhat conservatively, that important changes in incomes and life styles are inevitable if the massive efforts being mounted by the government and its donors are successful in any measure. We think they will be.

require them to buy food grains and enable them to buy rice.

(5) Continued urbanization will result in more demand for rice as new immigrants to the large towns adopt city consumption patterns.

(6) Dispersion of rice growing areas will make rice less foreign to consumers in areas that previously produced coarse cereals only.

As shown in Table 9, the hypothesis that rice consumption per capita will increase by four percent per year (H_2) results in a projected increase of 27 percent in total domestic rice consumption between 1976 and 1980. The projected total rice consumption increase (over 1976) for 1990 is 142 percent; for 2000 it is 383 percent.

To compensate for the projected increases in rice consumption per capita, coarse cereals consumption per capita would decline by about one-fourth, to 129 kilograms per capita, by 2000. However, total coarse cereals consumption would increase throughout the projection period in order to keep pace with population growth and to assure maintenance of the estimated per capita cereals requirement of 180 kilograms per capita. Under the H_2 assumptions, projected cereals consumption would be 28.5 percent rice, 71.5 percent coarse cereals. For 1976, the proportions are 11 percent rice and 89 percent coarse cereals.

Results under the other hypotheses (H_1 and H_3) are similar in direction, with the shift toward rice being somewhat less in the case of H_1, somewhat more for H_2. However, for H_3 the large and rapid increase in per capita rice consumption projected, 8 percent per year, would result in a decrease after 1985 in the total amount of coarse cereals consumed. Under this hypothesis, in 2000 cereals consumption would be 70.4 percent rice, 29.6 percent coarse cereals. The final year consumption patterns for H_1 would, in contrast, be 17.9 percent rice 82.1 percent coarse cereals.

In comparison with the total domestic cereals consumption needs projected in Table 9 the objectives formulated by the CNPER foresee a much more rapid shift to rice but very similar overall final produce need for cereals by the year 2000.

Table 10. CNPER Consumption Targets
(1000 metric tons)

	1978-79	2000
Millet, sorghum, corn	1168	700
Rice	227	1294
Total:	1395	1994
% Rice	16.3	64.9

SOURCE: CNPER, Situation de l'Economie Rurale Malienne en 1972, p. 367.

The CNPER projects consumption of 227 thousand tons of rice by 1979; our highest projection for 1980 (H_3) is 177 thousand tons. By 2000 the CNPER projects a need for 1294 thousand tons of rice, only 10 percent below our high projection (H_3) and more than twice the H_2 projection which we consider most reasonable. The total cereals need in 2000 projected by CNPER is only 40,000 tons less than our projections, 2034 thousand tons. However, they foresee a higher need in early years, because in their calculations they use a constant 2.3 percent population growth rate, as opposed to the initial 2.2 percent growth rate assumed here.

Projected Cereals Production Requirements

The total production levels of rice and coarse cereals required to meet domestic consumption needs plus the estimated production required for seed, losses, exports, and reserve stocks are summarized in Table 11.

Of interest in Table 11 is that even with the assumption that rice consumption per capita will increase by only two percent per year (H_1), production of paddy would have to increase by more than 200 percent by 2000 in order to maintain self-sufficiency.[8] Coarse cereals production

[8] Although self-sufficiency as here defined includes some allowance for exports, the percentage, and total amount, allocated to exports is very small. Seed use alone, usually 100 kilograms per hectare for rice, accounts for most of the 10 percent estimated for seed, losses and exports. Any significant loss rate would eliminate the possibility for exports given the production-domestic consumption ratios specified.

Table 11. Production Requirements to Meet Projected Domestic Consumption and Other Needs for Major Cereals, 1976-1980[1]

Crop	Hypothesis[2]	Year				
		1976	1980	1985	1990	2000
Rice	H_1	144	168	212	266	437
	H_2	144	182	253	349	696
	H_3	144	212	355	592	1720
Paddy[3]	H_1	221	258	326	409	672
	H_2	221	280	389	537	1070
	H_3	221	326	546	910	2645
Coarse Cereals	H_1	1152	1236	1386	1548	2004
	H_2	1152	1222	1345	1465	1745
	H_3	1152	1192	1243	1223	721
Rice & Coarse Cereals	H_1, H_2, H_3	1296	1404	1598	1914	2441
Paddy & Coarse Cereals	H_1	1373	1494	1712	1957	2676
	H_2	1373	1502	1734	2002	2815
	H_3	1373	1518	1789	2133	3366

[1]Included in the production needs estimates are an added 10 percent of final domestic consumption to be used for seed, cover losses, provide for normal exports. Also added is 10 percent of domestic consumption to allow establishment of security stocks. Min. de Develop. Rurale, Stock de Securité, p. 10.

[2]See footnotes 1 and 2 of Table K for a specification of the hypotheses.

[3]One ton of paddy equals 0.65 tons of milled rice.

would have to double. (1975-76 production was 975 thousand tons.) For hypotheses H_2 and H_3 paddy production would have to increase by 384 percent and 1097 percent, respectively, to maintain self-sufficiency. Coarse cereals production would have to increase by about 80 percent for H_2 conditions; it would decline by one-fourth for H_3.

Also of note is that at least temporary self-sufficiency in rice has been achieved this year and that the needs for 1980 under H_1 would be met with this 1975-76's paddy production level, 260 thousand tons. Assuming the higher H_2 consumption growth rate, production in 1975-76 was only seven percent below the projected needs for 1980.

Table 9 lists the land requirements to meet the projected production needs levels for 1985 and 2000 (Table 11) estimated on the basis of: (1) current average yield levels, 1.3 tons of paddy and 0.8 tons of coarse cereals per hectare, and (2) double current yields.

Table 12. Estimated Land Requirements to Meet 1985 and 2000 Cereals Production Needs

		1976	1985		2000	
			CY[a]	2XCY	CY[a]	2XCY
Paddy	H_1		251	120	517	258
	H_2	200	299	150	823	412
	H_3		420	210	2034	1017
Coarse Cereals	H_1		1732	866	1252	626
	H_2	1220	1681	840	1090	545
	H_3		1553	776	450	225

[a]CY = current yields derived from total area and total production estimates for 1976.

As the estimates in Table 12 indicate, meeting the rice (paddy) production needs projected under H_3 -- and CNPER's production targets -- for 1985 are very unlikely to be achieved unless yields can be improved substantially. With yields remaining at, or even close, to

current levels, not enough irrigated land could be developed in time. The H_3 and CNPER production projections for 2000 are clearly unattainable even with a doubling of yields. Indeed, the H_2 production level could be achieved only if yields double and most of the 500,000 hectares of potentially irrigable land is developed before 2000.

In contrast, production needs for coarse cereals can be met with a maximum area expansion of about 40 percent, 500,000 hectares, by 1985, provided a shift toward rice consumption occurs and current yield levels are maintained. An increase in average yields for these crops will in fact allow some reduction in the area devoted to their production under each of the three hypotheses. The reduction could be quite dramatic if yields double by 2000 -- not an unreasonable expectation -- whether or not there is a large or rapid shift of consumption patterns toward rice.

If consumption patterns shift toward rice at a rate of four percent per year, H_2, and yield increases of 50 percent can be achieved by 2000, total cereals production adequate to meet domestic needs and nominal exports could be achieved with no increase over 1976 in the total land area in cereals. A change in the ratio of land producing the two types of crops would of course be required.

H. INFRASTRUCTURE

1. TRANSPORTATION

Because extensive regions in northern Mali are desert, most of the population and economic centers (and thus transport infrastructure) are located in the southwest and along the Niger River. The principle international routes are via Dakar and Abidjan.

To date the most used route connecting Mali with the sea has been via the port of Dakar (excepting the period 1960-1963 after the breakup of the Mali Federation). The distance between Bamako and Dakar, using the railroad, is 1,200 KM, about half of which is in Mali. In 1974, the Senegal-Mali railroad had 326 freight cars (186 - Senegal, 140 - Mali) with an average capacity of 29 metric tons. On the average 20 railroad cars constitute a train; thus each train has a freight capacity of about 600 metric tons. The World Bank estimates that in a normal year there is about 100,000 tons of traffic through Dakar.[1] This figure was surpassed during the drought as a result of relief shipments.

The access route through Abidjan may be by either rail and road or by road. The rail and road route involves a rail trip from Abidjan to some point on the line to Ouagadougou, Upper Volta. (The most likely points to transship to truck would be either at Bobo-Dioulasso or Ouangolodougou.) Total distance on the Abidjan-Bamako via Bobo-Dioulasso is 1,200 KM as is the Abidjan-Bamako route via road. Mali traffic through Abidjan is about 60,000 tons per year, half import and half export.

Transport costs from Abidjan to Bamako are one-third to one-half higher than via the Dakar route as a result of both additional maritime freight costs and road transport costs. The latter are set at high levels because of poor road conditions and the lack of backhaul opportunities. The bottlenecks encountered in shipping via the Dakar-Niger railway are such, however, that even this large freight differential can be paid to bring goods more

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[1] IBRD, "A Note on Transport Problems in the Sahel," August 1975, p. 17.

expeditiously through Abidjan. Cotton exports also tend to take the Abidjan route because of the location of the ginning plants.

Table 13. Railroad Freight Charges: Rates for Selected Commodities, 1967-1975 (Mali francs/ton)

Applicable in:	Salt	Sugar	Agricultural Equipment	Fertilizers
(A) Abidjan to Bamako				
January 75	30,204	33,030	-	30,251
September 70	22,858	-	30,027	25,492
May 67	24,290	26,309	33,357	26,952
(B) Dakar to Bamako				
January 75	21,392	24,890	39,217	20,637[a]
September 70	16,143	-	38,240	17,492
May 67	19,347	20,953	20,603	18,629

SOURCE: Office National du Transport, Bamako, (From Elliot Berg, The Recent Economic Evolution of the Sahel, p. 159.)

[a]Recent data indicate that this rate has been further increased to 23,400 MF/ton. See Ministère du Développement Rural, Stock de Securité, p. 39

Domestic Transport Infrastructure

Mali's internal transport system is fairly efficient in serving the populated areas of the country (except the Sixth Region). The physical infrastructure consists of approximately 13,000 KM of roads, of which 5-7,000 are suitable for year-round travel; the remainder are secondary gravel roads and tracks. The road density is approximately 16 KM of improved road per 1,600 square km. (This compares with: Chad 1.6, Niger 8, Senegal 59, and all Africa 62).[2]

[2]See Development Trends in the Sahel: Background Statistics, in materials presented at the Club des Amis du Sahel inaugural meeting, March, 1976.

The adequacy of transport infrastructure varies immensely by region. Some regions have an excellent primary route network (Zone Sud for example); others have quite inadequate road networks and must rely on river transport, usable only during approximately seven months of the year (Sixth Region, Zone Lacustre). However, all zones, without exception, suffer from one of the major constraints facing Malian agriculture today -- an inadequate and deteriorating feeder road network.

Large areas of Mali are inaccessible during the rainy season. For example, after a few rains the villages between Kangaba (Haute Vallée) and the Guinean border can be reached only by boat (and not all of them at that). This difficult accessibility has serious repercussions on: (a) the ability of extension services to reach farmers; (b) the development of cash crop agriculture; (c) marketing of cash crops and cereals; and (d) the supplying of Mali's deficit areas.

It is also worthy of note that the deteriorated condition of a great part of Mali's feeder roads causes considerable expense to the country's vehicle fleet. Transport shipping costs illustrate this situation very well: the price per kilometer per ton set by the government is 26.40 MF on good routes and 52.80 MF on poor routes. For different size trucks, on good routes, the breakeven costs of transport have been estimated to be the following.

trucks, over 25 tons:	23.75 MF
10 tons:	34.35 MF
5 tons:	47.90 MF

Only trucks of 25 tons and over can hope to make any profit at all on good roads. Their owners quite often refuse to risk their equipment on poor routes at the prevailing government rate.

The transport situation is one of the most serious constraints on Mali's ability to market its crops. Costs are so high that they sometimes equal or exceed prices paid to producers. For example, in 1974-75 millet was being bought unofficially for 20 MF/kg; the cost of transport Bamako-Gao was calculated to be 22,827 MF/T (excluding taxes).[3]

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[3]France, Ministère de la Coopération, Mission de restructuration de l'office des produits agricoles du Mali (OPAM). Paris, BDPA, May 1975, p. 40

2.. STORAGE

There is general agreement among Malian officials and outside observers that there is lack of adequate agricultural storage at one level or another and that this lack is a serious and growing problem. This section outlines and briefly evaluates storage needs now and in the future.

Cereals

Augmentation of storage for marketed cereals is considered to be among the more pressing needs to be met through government action in Mali. The need for more storage as perceived by most government officials has two aspects: a need for more central storage in localities where it is lacking, in general at the level of the cercle, and a need for security stocks to be built up as insurance against the effects of renewed drought.

We encountered on almost all levels of officialdom an advocacy of building more central storage facilities. The advantage seen in having more central capacity is that distribution would be easier when harvests have been poor. There are also serious disadvantages, however, some of which may not have been given their just due. The most important are high costs and the risk of loss or spoilage. With regard to the latter, it is worth noting that in addition to the risky conditions that already exist in many warehouses, it is probable that the government policy of having no grading system for coarse cereals results in the purchase of below-average quality grain with below-average storability.

The alternative of emphasizing on-farm rather than central storage might reduce these potential costs and risks. It is noteworthy that certain ethnic groups -- the Dogon are the prime example -- have improved traditional storage methods to the point where they are quite efficient.[1] We therefore consider it advisable to think of ways in which additional quantities of on-farm storage for millet and sorghum could be encouraged. Larger surpluses might thereby be accumulated and might be induced into the market when and as needed. (Once into the marketing circuit, these volumes would of course

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[1] Although we were told in one village on the Séno Plain that midway between harvests, in June, the granaries were only half full, we were also told that there had never been imports from outside in the memory of those assembled -- some of whom were quite old. In other villages we were told that they hold enough millet for the current year plus two more.

require temporary storage facilities, but the objective should be to move them to deficit zones more efficiently than is now the case and thus avoid tying up scarce central storage space for long periods.)

Two methods by which farmers might be encouraged to store larger volumes on their farms would be either to pay them a storage premium over the official price at a later date in the year[2] or else to allow the official price to fluctuate close to the free market price and thereby permit farmers to cover the cost of carrying stocks. At this point we will limit ourselves to making the suggestion and will return to pricing policy in Part II. It should be remembered, however, that collective village groups often have claims on the stored cereals of their members, and these claims certainly render more complex the decision-making of the farmer, who as a purely economic actor might respond favorably to greater inducements for on-farm storage.

Central Storage

The central storage capacity which does exist for cereals is, with the exception of a scattered private capacity of unknown size, owned by OPAM, the office des Produits Agricoles du Mali.

As illustrated by Table 14 almost one-half of the total storage capacity is in Bamako, Mopti and Gao, i.e. at the major points of final consumption or transshipment. The rest is scattered relatively evenly among 19 capitals of cercles. The capitals of the remaining 20 cercles not listed have no OPAM storage. This illustrates one of the storage problems faced by OPAM. With no facilities, these 20 cercles are forced to store needed grain in rented warehouses not always suited for the purpose or even under tarpaulins. Storage of the latter type is inadequate during the dry season, and results in large losses if still in use when the rains begin. Moreover, in some cercles endowed with storage, the capacity is inadequate to accommodate the excess grain produced within the cercle or imported from

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[2] Suggested by IDET-CEGOS, Etude des Structures des Prix, May 1976, vol. II, p. 99. The mechanics of how this would work are not clear from the short description in the text. While in Mali we were kindly permitted to consult this valuable study. It should be noted that its findings and conclusions had not yet been approved by the Malian Government.

Table 14. Storage Capacity of OPAM
(metric tons)

Region	Location (town)	Silos	Warehouses	Total Region	% of Total
1st Region	Kayes	3,300	4,000	7,300	8
2nd Region	Bamako	12,100	10,000	28,100	31
	Koulikoro		5,000		
	Nara		1,000		
3rd Region	Sikasso		4,000	9,000	10
	Bougouni		4,000		
	Koutiala		1,000		
4th Region	Segou		3,000	7,000	7.5
	Macina		2,000		
	Niono		1,000		
	Tominian		1,000		
5th Region	Mopti	8,800	4,000	18,800	20.5
	Nantaka		3,000		
	Djenne		1,000		
	Bankass		1,000		
	Koro		1,000		
6th Region	Gao	3,300	7,000	21,300	23
	Bourem		1,000		
	Dire		4,000		
	Goundam		3,000		
	Kabara		2,000		
	Kidal		1,000		
Total		27,500	64,000	91,500	100
% Total		30%	70%	100%	

SOURCE: IDET-CEGOS, Etude des Structures de Prix, Vol. II, p. 2.

other areas to meet local deficits. For example, at Bankass we saw several hundred tons of sacked grain outside under plastic in mid-June, more than two weeks after the rains had begun.

The total storage capacity of OPAM is probably adequate for official grain marketings at the levels of recent years. (See Table 15.)

Table 15. OPAM Purchases of Cereals, 1967/8 to 1973/4

Region	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74
Kayes	5.30	0.18	1.69	0.08	3.43	-	0.72
Bamako	11.13	0.14	4.66	0.95	7.16	1.85	1.30
Sikasso	10.73	2.16	8.56	5.53	5.95	7.20	3.96
Segou	18.44	4.66	7.38	2.12	6.03	0.84	0.45
Mopti	12.09	-	4.08	3.20	6.02	1.03	3.81
TOTAL:	57.69	7.14	26.37	11.88	28.59	10.92	10.24

Note: The total for 1974-75 was 55.3 and for 1975-76 was estimated by OPAM in June 1976 to have been 41 to 42.

SOURCE: IDET-CEGOS, op. cit., II, p. 8.

Assuming no carryover stocks, up to two-thirds of the volume of official marketings requires storage. The maximum would occur in April or May when the official buying season ends and net consumption drawdown has not begun. Therefore, it would appear that much of the apparent problem could be eliminated through better management. However, because the storage is not available in all places having a need for consumption stocks and because rapid shipment is impossible, the problem cannot be solved so easily. Some storage for marketed cereals is needed both in production areas and at consumption centers. Storage at intermediate points should probably be limited to that necessary for accumulations of adequate quantities for transhipment. That is, a center should probably have no more storage than necessary for local needs plus holding of small lots received until a truckoad or two is accumulated.

There are other ways in which management of stocks might be improved. For example, shipments of cereals to Gao from Bamako and Mopti should be scheduled for movement near the end of the calendar year, when river transport is usually possible. This implies an earlier start to the official buying campaign. It also means construction at Gao of storage facilities adequate for 8-10 months of imported (from other areas) cereals needs, plus some storage for grains to be trans-shipped to Niger. Further, private facilities that are suitable and available should be used. No convincing argument on other than national economic efficiency grounds can be made that OPAM should duplicate existing private storage.

Looking to the future, as more cereals enter marketing channels roughly in proportion to population growth adjusted for increased urbanization and changes in exports, cereals storage capacity will probably have to be increased at an annual rate of from three to five percent.

Another aspect of cereals storage relates to paddy awaiting milling. At the rice mill at Sevaré there is storage capacity of 4,000 tons, which would probably be enough if the rice came to the mill in a regular flow throughout the 11-month milling season. Unfortunately it does not. Last year several tons were stored outside and passers-by were finally invited to help themselves to avoid total loss when the rains began. To "solve" the problem the mill is now refusing to accept paddy when its storage capacity is filled. Thus it is passing the problem back to individual farmers, which forces a change in the timing of marketing and requires the building of more on-farm storage. In the case of rice, it is not clear that this is the best solution to the problem. One result already seen is a lower quality of paddy delivered to the mill.

Cotton

Seed cotton storage is the responsibility of individual farmers and/or village producer associations (groupements ruraux) until it is delivered to CMDT at designated buying points. Because CMDT's buying program runs relatively well as the harvest progresses, little storage is needed at this level and current facilities appear adequate. However, at the cotton gins

there is a problem of inadequate storage for seed cotton awaiting processing, ginned cotton, and cottonseed.

Because the CMDT is trying to avoid discouraging farmers as a result of allowing build-ups of unpurchased seed cotton, they schedule purchases according to the rhythm of harvest, not according to ginning needs. The result is unginned cotton on hand throughout most of the year in excess of storage capacity. Estimates are that current capacity for this purpose should be doubled or tripled.

The problem for ginned cotton is even worse. At Koutiala this year 6,000 tons of ginned cotton were stored outside when the rainy season began; about 3,000 tons were outside at Sikasso. As explained in section I(L) on marketing, at least a partial solution to the cotton fiber storage problem could be solved by moving the fiber into the export market more quickly or on a regular basis.

Cottonseed is stored outside at all of the gins, with about 25,000 tons on hand at Koutiola and Sikasso at the beginning of the rainy season in 1976. As a result, much of this may have been lost to fermentation. Here also, more rapid movement into export or domestic markets could partially solve the problem, but some cottonseed storage capacity is definitely necessary. With the Malian Livestock and Meat Marketing Board (OMBEVI) planning to increase the use of cottonseed for stock feeding at subsidized prices, storage capacity will be required to provide a carry-over supply at the end of the rainy season before the new crop has been ginned.

For each of these three products -- seed cotton, cotton lint and cottonseed -- the rapid growth in cotton production which promises to continue will require commensurate increases in storage as well as ginning capacity.

Peanuts

Peanuts stored at the farm level for consumption or for seed are susceptible to weevil (bruche) attacks. Chemical treatment by methyl bromide or phostoxin, costing about 4 MF/kg, is considered by OACV to be very effective. The sector chief for Kita, the largest producer in the country, reports that up to one quarter of the sector's farmers do the treatment.

In 1975-76 OACV undertook a new program for peanut seed storage that combines effective chemical treatment with decentralization to the village level. The Operation has had a favorable response in the Kayes sector to a program under which it exchanges 100 kg of selected and treated peanut seed for 115 kg of a farmer's harvested peanuts. The farmers who make the exchange then store their seed under treatment in collective granaries of at least six-ton capactiy built to OACV specifications. The advantages are that it avoids central storage problems for OACV between harvest and planting and that the farmer does not have to go into debt to buy seed. The Kolokani sector has a goal of 100 such collective granaries in 1976-77 but expects to surpass that number, such has been the interest in the program.

3. RURAL EDUCATION

In 1972 enrollments at the lower primary school level (grades 1-6) in Mali were 18 percent of the appropriate age group, among the lowest in Africa. The situation was compounded by the dropout rate: only 43 percent of those pupils who entered the first grade were still enrolled in the sixth grade. A very high proportion of the 57 percent who dropped out along the way will revert to illiteracy. It is therefore not surprising that one of the principal objectives of the 1974-78 Plan is to extend functional literacy so as to increase the number of adults who can read and write from 70,000 to 200,000. Several non-formal education programs designed for the rural sector have in fact concentrated on functional literacy. In this section we discuss three such programs.

Centres de Formation et d'Animation Rurale (CFARs)

The National Training and Rural Animation Service had its origins in the former Service Civique and in the seasonal agricultural schools (ecoles saisonnières). The two were merged in 1966; 45 of the most viable camps and schools were named Centres d'Animation Rurale. In 1974 they were reorganized, along with a UNDP/ILO rural training project (Centres d'Orientations Pratiques), into a new National Service within the Ministry of Rural Development and were renamed Rural Animation and Training Centers (CFARS).

Of the 46 centers which are open and functioning, 7 serve as border guard posts, 11 are old Service Civique camps, and 28 are former seasonal agricultural schools. Three centers, one of which opened in January 1976, train married couples (centres mixtes). Most centers are located in the Regions of Bamako, Sikasso and Ségou, and in the southern part of the Kayes and Mopti Regions. Only one center is located in the Gao Region. Despite the importance attached to accessibiltiy during the rainy season, only 10-15 centers (all located next to major paved roads) can be reached throughout the year.

Currently each CFAR is staffed by a chief of center and usually an agricultural agent permanently assigned to the National Service. A former Service Civique cadre usually takes charge of military training, discipline,

recreational activities or agricultural fieldwork. The continued use of Service Civique cadres reflects the belief that discipline and regimentation are necessary for the centers to function effectively.

The mode of recruitment into the CFAR's is similar to that practised for the Service Civique camps. All young men between the ages of 18 and 25 who would otherwise be eligible for military service and who usually have not attended primary school are eligible for CFAR service. CFAR training for two years fills military obligations and frees a recruit's parents from paying annual head tax for him during his two years of service. At the end of two years, a trainee is usually eligible for a pair of work animals, a plow, and an ox-cart to be repaid over five years. Unfortunately, funding has not always been adequate to provide this equipment, and some dissatisfaction with the program has resulted.

The CFAR two-year training period is divided into two stages. The first stage lasts six months and is devoted solely to military training. Agricultural field work, some courses in agricultural production, functional literacy, and light maintenance and construction work occupy the second stage (the remaining 18 months). CFAR personnel are also under considerable pressure to teach French, which is not part of the official curriculum.

Contact between the CFARS, the surrounding villages, and the relevant agricultural development Operations is slight. The Operations do not use the centers (nor do the CFAR's offer themselves) as demonstration centers for short-term farmer training. Contact between the agricultural instructors in the centers and extension agents is more often social than professional. In fact, instead of collaborating with the National Service, Operations often seek to establish their own independent farmer training centers. This is the paradox of the CFARS: while they represent the major rural training service in Mali, they are isolated from the farmers and out of touch with the major organizations responsible for agricultural development.

The centers could benefit from effective follow-up services to former trainees. (The centers themselves are neither financially capable nor physically equipped to provide these services). The National Service insists that trainee follow-up is the responsibility of the extension services within the rural development Operations. However, not only is there little contact

between the two; the Operations also lack a policy for identifying and using CFAR trainees as "pilot farmers." When agricultural agents (on their own personal initiative) have sought out former trainees to use as "pilot farmers," the latter are reported to be good farmers, most receptive to new agricultural techniques and advice.

Functional Literacy

The functional literacy program consists of extending literacy training in indigenous languages to adults in a given zone. The purpose of the program is to enlarge the comprehension of the rural producer and hence to increase his openness to innovation. It is hoped that such training will also impress upon adults various useful ideas for the improvement of rural life in general (e.g. better health and hygiene practices or different ways of organizing socially and economically).

Introduced in 1968 (with the assistance of UNESCO/UNDP), functional literacy has become an important element of the government's total education program. It has been difficult to determine the exact number of functional literacy centers in operation. One estimate (1974) contained the following breakdown:

Operation Coton	1324
Operation Arachide	705
Office du Niger	190
different Operations Riz	113
Total Centers in Operation	2,392

Data from Operation Riz Ségou for 1976 show 186 centers. However, the number actually functioning in accordance with the program's objectives is estimated to be far less (about 60 percent). In OACV, of the 716 centers created, 480 are still functioning, and 180 are temporarily closed.

The village population, in creating a Centre d'Alphabétisation Fonctionnelle (CAF), accepts the following responsibilities:

(1) organize a local village literacy council, presided over by the village leaders;

(2) construct and furnish a building for the center;

(3) provide kerosene for the center's lamp and batteries for the

center's radio; and

(4) choose two voluntary animateurs among the literate of the village to teach the center's courses.

In principal, the first center in a zone will produce graduates who can then open other centers in other villages. The teaching is one hour per night, five nights a week, for two phases of six months each. A first step is for the farmer to develop the skills of reading, writing, and counting to a level where he can use them for such things as calculating family taxes or for recording purchases of agricultural inputs or crop sales.

Materials (worth about $80.00 per center) are provided from Bamako and are by language (Bambara, Peul, Songhai, Tamashek) and by crop to meet as nearly as possible the needs of the area in which the course is held. The comparatively low cost of functional literacy (estimated at $16 per person per year) is made possible because the majority of the 2,500 animateurs responsible for conducting literacy classes are volunteers. Those who are not volunteers are already employees of the Operations (usually moniteurs and encadreurs) and offer literacy training as an integral part of their extension activities.

While the quantification of functional literacy benefits is very difficult, there appears to be a consensus among Operation staff and farmers that functional literacy has a positive impact on:

(a) the learning of new agricultural techniques,

(b) the ability to market products, and

(c) overall ability to manage farm affairs and even community affairs.

However, the existence of literates in the villages poses the problem of the utilization of skills learned. This is presently the priority problem (and challenge) of the program. In the long term the possibilities open for using (and thereby reinforcing) what they have learned will be one main factor motivating people to invest time and energy in the program.

It is not clear exactly what these possibilities may be. An ability to read and count opens new opportunities for rural and community development. Will this mean that the new literates can take over local-level tasks (e.g. staffing of local cooperatives, responsibilities in collection

and marketing of crops or in agricultural extension)? The answer will have implications for the government's total rural development effort, for it relates to the crucial question of the extent to which villagers participate in development.

Community Development Center

Another promising attempt to increase local capacity to become involved in rural development processes are the Centres de Développement Communautaires. These local level organizations, similar to the functional literacy centers, are set up with a minimum of outside support; their success depends on local resource commitment and participation.

Their activities range from health education (training of midwives, methods of childcare, hygiene and malaria prophylaxis to local craft activities.) In one center we visited at Sansanding (Opération Riz Ségou) a successful women's cooperative had been organized around the buying, dyeing, and selling of material. This activity enabled a number of local area women to add to their family earnings; it also increased their participation in the area's Community Development Center's many other programs, one of which was a thriving day care center.

Participation in Rural Development

In whatever way the rural development effort evolves in Mali, a crucial question will be whether farmers are caught up in it as participants or simply remain takers of what the government chooses to give them (from prices to social services). It is true that in recent years some of the Operations have achieved considerable success in the production and marketing of their crops, but the (essentially passive) role of the Malian farmer does not seem to have changed. In the long run, it is only through involving the local population in the planning and implementation processes that those in charge of rural development can hope to bring about the behavioral changes and resource commitment necessary to make the effort self-sustaining.

One attempt to give farmers a sense of participation and responsibility was the creation of rural cooperatives (groupements ruraux) in the early 1960s. Members were to become involved in marketing their own farm products and in controlling the sale of essential consumer goods. The cooperative

movement was essentially imposed from above, however, and its roots have never been strong. It may be that the movement can be revived if villagers take the initiative and are encouraged in turn by the authorities. In any case, cooperatives remain one of several ways in which farmer participation can be increased. It is in this context that programs such as Functional Literacy and the Community Development Centers become important (at least for starters) as they open possibilities for rural people, male and female, to participate in the design, implementation and evaluation of rural development.

I. AGRICULTURAL RESEARCH AND PRODUCTION TECHNOLOGY

Research Organization

The Institute of Rural Economy (IER) coordinates and controls agricultural research in Mali. Agricultural research is actually conducted, however, by French institutes belong to GERDAT (Study and Research Group for the Development of Tropical Agronomy). Members of GERDAT working in Mali include the Research Institutes for Tropical Agronomy (IRAT), Cotton and Textiles (IRCT), and Oil-seed crops (IRHO). Staff of these institutes in Mali has been largely French, but an effort is now underway to replace French with Malians. Junior and technician-level staff are now almost all Malians. Malians also make up from one-third to one-half of the senior staff, and most of the remaining French are working with Malian counterparts who are slated to replace them.

Mali cooperates with regional and international agricultural research institutes including WARDA (West African Rice Development Association) at Monrovia, Liberia and ICRISAT (International Crops Research Institute for the Semi-Arid Tropics) located at Hyderabad, India. These institutes cooperate with Malian researchers in testing rice, sorghum, millet, maize and wheat varieties and in applied production programs adaptable to Mali.

The IRAT Mission/Mali conducts agronomic research in seven different zones based on cropping suitability, soils, climatic conditions and annual rainfall. IRAT has a central station at Sotuba, 8 km east of Bamako, and two other stations at Kogoni in the Office du Niger and at Mopti-Ibetemi. Plant breeding in millet, sorghum, maize and cowpeas is conducted at the central station. A rice breeder works at Mopti-Ibetemi.

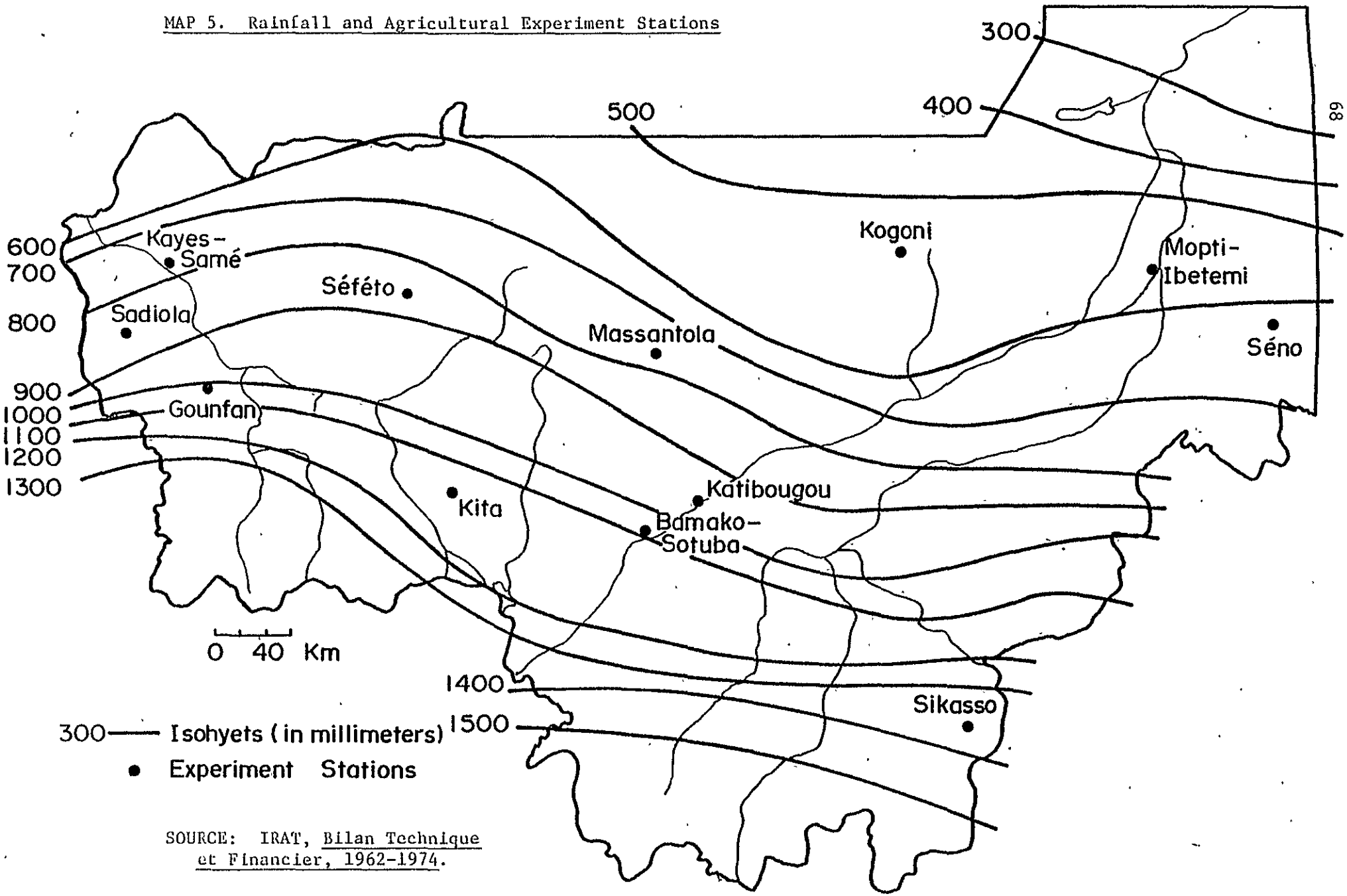
Regional sub-stations (Points d'Appui de la Recherche) conduct trial research studies at:

a) Sēno (Koporo-Keniepé). 580 mm rainfall. Crops: Millet, cowpeas, sorghum; rotations; soil fertility and cultivation techniques.

b) Sikasso. 1290 mm rainfall. Crops: lowland rice, upland rice, maize and soybeans. IRCT carries out cotton research at Sikasso.

c) Kita. 1100 mm rainfall. Crops: sorghum, maize, millet and peanuts.

MAP 5. Rainfall and Agricultural Experiment Stations



SOURCE: IRAT, Bilan Technique et Financier, 1962-1974.

d) Koulikoro. 900 mm rainfall. Crop: peanuts.

Smaller adaptive research stations (Points d'Expérimentation Permanents) for testing crops under differing climatic and soil conditions are located at:

a) Séféto, 80 km north of Toukoto in the First Region. 600-700 mm rainfall zone. Crops: peanuts, cowpeas and millet.

b) Massantola, between Kolokani and Banamba in the Second Region. 800-900 mm rainfall zone. Crops: sorghum, millet and maize.

c) Sadiola, 80 km south of Kayes in the First Region. 900-1000 mm rainfall zone. Crops: sorghum, millet, maize and peanuts.

d) Goufan, 50 km southwest of Mahina in the 1st Region. 1000-1100 mm rainfall zone. Crops: sorghum, millet maize and peanuts.

Research on cotton and dah (kenaf) is conducted at a main station at N'Tarla, close to Koutiala, with applied testing at 3 PAR and 3 PEP facilities. IRCT and CMDT work together on cotton and kenaf studies.

Regional Research

The multistate Senegal River basin development organization (OMVS) has one of its research stations at Samé, 15 km west of Kayes. The station, opened in 1967, is supported in part by grants from FAO and US/AID. It has conducted experiments on millet, sorghum, maize, cotton, wheat, and tomatoes for canning. It would like to test pipe and cigar varieties of tobacco leaf. In the early years there were frequent changes of program as directors of the station changed. It has been difficult to determine what the initial results were since they were sent to France for statistical analysis. Samé is now concentrating on testing local varieties and is particularly looking for crops that will survive the hot part of the dry season.

Crop Improvement Research

Crop varietal development and testing have high priority in crops research. Varietal testing is conducted at almost all IRAT Mission/Mali stations in crops of importance to the zone. New varieties are screened, tested, selected and multiplied for distribution to farmers, usually by means of an exchange for unimproved seed.

It is in pearl millet that results so far have been least satisfactory. The improved, semi-dwarf local variety M2D2 is gaining some acceptance in the 400-600 mm rainfall zone. It matures up to 30 days earlier (110 days) than other millets being grown in Mali. It is the variety being recommended in Operation Mil Mopti and will yield up to 1500 Kg/ha with good rainfall distribution and crop management.

In higher rainfall zones longer-maturing millet varieties (145 days) M9 and M12 are recommended because of adaptability and a capability of yielding up to 2300 Kg/ha, demonstrated in IRAT trials at Sotuba. These are improved local varieties that do not degenerate from generation to generation. It should noted, however, that tests of M2D2, M9, M12, and local varieties at the PEP facilities in both 1974 and 1975 gave disappointing results. Even so, M12 did as well as or better than any local variety, while M9 showed it performs better in a year of low rainfall. Low yields and parasite attacks are cause for concern to IRAT, which is seeking new millet varieties for the First Region.[1]

For sorghum, as for pearl millet, qualities of taste, texture and color are important considerations for the farmer and consumer. Although some sorghum selections have yielded up to 6000 Kg/ha in trials their quality is considered unsatisfactory.

The local sorghum selection Tiémarifing is popular and yields well in the 800-1100 mm rainfall zones. Yields of 2400 Kg/ha have been obtained in trials. Gnofing and Tioadi are also good yielding and recommended for this rainfall area. Gadiaba (90-110 days) is popular in the northern part of the Kita sector.

CE 90, a semi-dwarf sorghum variety from Senegal that is only 1.60 M in height (compared to 3.80 M for Tiémarifing) has performed well in the 500-600 mm rain fall zone. The variety requires 30 days less growing time than Tiémarifing. Seven or eight other sorghum varieties are also grown and are acceptable both in yield and to consumer tastes.

For maize, a local selection, Tiémantié, has yielded up to 3500 Kg/ha in trials and is adapted to the 900-1400 mm rainfall zones. Kogoni B, a

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[1] Mali, Mission IRAT, Rapport Synthétique de la Campagne 1975-1976. Bamako, April 1976, pp. AMS-5 and PEP-5.

75-80 day variety is better adapted to the lower-rainfall Kayes area.

Peanut varieties being offered to the farmer are well suited for the wide range of moisture and climatic conditions in Mali. A newer 80-day Spanish-type eating peanut (55-437) is performing satisfactorily in rainfall areas as low as 350 mm/year. Good distribution of rainfall, however, is required for top yields. This can have special importance since peanuts can now be produced in rotation with millet and early sorghum in rainfall-short zones. In higher rainfall areas the Virginia-type peanut (28-206) requiring 120 days is better suited for the oil industry and is higher yielding than 55-437.

Several varieties of cowpeas have been developed that are suitable for rainfall zones from 400 mm/year (early varieties) to 1200 mm/year (late varieties).

Many varieties of rice have been tested, selected and multiplied for seed production. These include rice grown under rainfed, controlled and semi-controlled growing environments. Selections from world-wide collections are tested.

Cotton research has focused on length and strength of fiber, yields and disease resistance. Research developed BIA SM 67, which is now a widely-accepted variety in the south. Its characteristics are a ratio of lint to seed cotton of 37.5% and average staple length between 1-1/32" and 1-1/16". BJA-592 is also produced in Mali. The success of cotton and kenaf production in Mali is to a large extent the result of varietal and adaptive research in Mali, according to several sources.

Kenaf research focuses on varieties with proper vegatative cycles and adequate resistance to the disease anthrachnose. Retting and fiber quality are also considerations in varietal selections.

Soils Research

IRAT research shows that Malian soils and especially upland soils are low to very low in available phosphorus. In trials conducted with maize, cotton, millet, sorghum and peanuts, a significant yield response to phosphate fertilizer occurs in three out of four experiments. Results with rice are less clear but probably reflect the difficulty of conducting fertility research with rice more than the lack of need for phosphate in rice

production. Trials with rainfed rice in the South show a good phosphorus fertilizer response.

Mali has phosphate deposits 80 km north of Bourem in the Tilemsi Valley. Tilemsi phosphate is reported to contain between 25 and 32 percent P_2O_5. Research results suggest excellent yield response from these naturally-occurring phosphates if they are finely ground and applied a year in advance of crop production.

Roger Montgomery discusses the tests conducted at the Sotuba station in his paper on fertilizer use in Mali and Upper Volta. After pointing out that it is "unfortunate that additional tests were not conducted with varying levels of natural rock phosphate and low or zero levels of N and K_2O" he concludes that "the level of initial application of 500 kg of Tilemsi rock phosphate, when ground to the point that over 60% of dry weight was less than 200 microns in diameter, is a profitable undertaking, as along as the price of the ground rock phosphate can be kept in the range of 50-100 FM per kg."[2] Subsequent to Montgomery's paper, Mission IRAT has reported the results of a similar test comparing the effects of Tilemsi phosphate (25% P_2O_5) and Taiba phosphate from Senegal (37% P_2O_5) on a rotation consisting of fallow/maize/cotton/rain-fed rice at Sikasso. The phosphate was applied during the fallow year. Results showed that increases in the phosphate dose had a linear effect on rice yields and that when used in equal doses, Tilemsi and Taiba phosphates gave equivalent yields.[3] On the other hand, the final series of the Sotuba tests on a rotation corn/peanuts/sorghum/peanuts/sorghum seems to show that in the fourth and fifth crop years, Taiba phosphate was superior to Tilemsi.[4]

With regard to nitrogen fertilizer, response is slight unless nitrogen is applied in combination with phosphate fertilizer. The combination

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[2]Roger Montgomery, "The Economics of Fertilizer Use on Sahelian Serials: The Experience in Mali and Upper Volta." Report for US/AID, 1976, pp. 100-101.

[3]Mission IRAT, op. cit., p. AGP-5.

[4]Ibid., p. AGP-4.

produces significant yield increases over phosphate alone. This is especially true for maize. There is a growing need for nitrogen fertilizer in Mali for non-leguminous crops including cotton, sorghum, maize and rice.

Most soils are believed to have adequate supplies of potash, sulfur and micro-nutrients, but research in this area of soil fertility has been limited and the subject requires more thorough investigation.

Research in cotton fertility suggests that nitrogen, phosphorus, potash, sulfur and boron are all required in fertilizer for cotton production on some soils in Mali.

Seed Multiplication

The African Development Bank, the UNDP, and the Arab Emirates of the Persian Gulf have agreed to finance a seed multiplication project that will establish a network to cover the needs of the development Operations for cereal seeds. A feasibility study published by the Institute of Rural Economy in January 1975 recognized that up to that time "the development Operations have had no real program for the distribution of selected seed for upland cereals."[5] The project will therefore establish such a program and will also improve the multiplication of rice seed.

The feasibility study points out that the existing network produced seeds that were not certifiable and in insufficient quantity. The project proposes to create a new research station at Diré to produce foundation seed (semences de base) and three new seed multiplication farms at Dogofry in the Office du Niger, Diré, and Gao.

The new network would thus have four stations (Diré, Kogoni, Mopti, and Sotuba) producting foundation seed and ten multiplication farms. The latter would be divided into three groups:

(a) Rice seed only: Mopti-Nord (for Operation Riz Mopti), Dalabani (for Mali-Sud) and Dogofry (for the Office du Niger).

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[5]Ministère de la Production, Institut d'Economie Rurale, Projet de Développement de la Production des Semences Selectionnées au Mali, Rapport de Factibilité. Bamako, January 1975, p. 7.

(b) Rice and other cereals: Babougou (for Operation Riz Ségou), Diré and Gao.

(c) other cereals: M'Pesoba, Baguineda, Samanko and Samé.[6]

Further multiplication of seed will be entrusted to seed multiplication farmers chosen by individual Operations and hired on a contractual basis. The system may be based on OACV's apparently successful use of pilot farmers to multiply peanut seed within its zone.

OACV now uses pilot farmers to multiply small quantities of selected cereal seed, which is given to them free of charge. Once multiplied, the seed is exchanged, kilo for kilo, for the unimproved seed of farmers who are interested in using the selected varieties the following year. The process is a slow one. Not only is selection of the best cereals varieties for local conditions in its infancy compared to cash crops. There is also (a) the reluctance of farmers to grow much of a new variety until they know they like it and (b) their readiness to trade small quantities of seed among themselves, making it extremely difficult to determine what yields are at the farm level. It is instructive to note that in 1975-76 OACV sold on short-term credit 6,073 T of selected peanut seed but gave away or exchanged only 32 T of improved millet and sorghum seed, 3.6 T of maize and 1.7 T of rice.

The new program for cereal seed will hasten the process, but it will clearly be some time before adaptive research produces the best varieties for the different zones in Mali and before farmers are prepared to grow them in quantity.

The feasibility study also foresaw the distribution of selected cowpea seeds as soon as technical problems had been resolved by research. It considered cowpeas to be the most promising legume at the present time, particularly for the semi-arid zone, and was optimistic that selected cowpea would be readily taken up. The IRAT report for 1975-76 indicates that seven

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[6] Financing for Mopti-Nord is from the IBRD and for Dalabani from the European Development Fund. Samé and Babougou have been financed by UNDP. The national budget supports M'Pesoba, Baguineda and Samanko, while the Office du Niger covers Dogofry's costs.

good varieties of cowpeas have been tested and are ready for distribution. Small quantities of cowpea seed (2-3 T per sector) were in fact to be distributed in 1976 to farmers in the OACV zone who use animal traction.

Assessment of Production Technology

Results from research and pilot farmer programs show that there is technology in Mali that can significantly increase yields of food and cash crops. Agronomic advances and changes in crop and soil management that demonstrate these technologies include:

(a) Improved seedbed preparation and tillage: Results from Operations Mil Mopti and Riz Ségou show that animal traction is a first step to increasing crop yields. A better seedbed and more timely farming operations can be achieved. Animal traction also makes for an enlarged farm operation. For sorghum, millet, maize, cotton and semi-water-controlled rice, plowing with the first rains (labour en humide) has in the past been a recommended practice in Mali. However, research conducted at the Points d'Experimentation Permanents (PEP) in 1975 indicates that plowing is not clearly superior to cross-harrowing (grattage croisé) to a depth of about two inches before planting. (The latter technique is now recommended for peanuts by OACV.) Plowing usually causes a delay in planting and can thus have adverse effects on yield. It has been shown experimentally that plowing stalks under at the end of the rainy season produces beneficial effects on succeeding crops.[7] This technique may not be practical on a wide scale, however, since it can conflict with harvesting. Nor is it worthwhile in low rainfall areas where lack of soil humidity prevents decomposition during the dry season.

(b) Timely Weed Control: Even small weed populations can significantly reduce yields of upland crops and irrigated rice, particularly under conditions of low fertility and moisture. Pilot farmers in Operation Baguineda have greatly increased sorghum and millet yields by weeding 10 days after seeding, with a second weeding 15 days after the first. A third weeding is sometimes required, especially if there are populations of parasitic witchweed (striga). Chemical weed control provided good results in experiments on peanut fields in the Kolokani sector in 1975.

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[7] Mission IRAT, op. cit., p. PEP-1.

(c) Planting in Rows: Planting sorghum, millet and most other crops in rows allows for animal-drawn cultivation. The multiculteur[8] is especially popular with pilot farmers in Operation Baguineda and in OACV because it has attachments for plowing, cultivating and hilling. Operation Riz Ségou has also had success and farmer acceptance of planting rice in rows and cultivating after rice emergence but before flooding. Pilot rice farmers have increased yield from 1400 kg/ha with broadcast seeding and no weeding to 2500 kg/ha with planting in rows and cultivating.

(d) Seeding Equipment: Small seeding equipment speeds up the seeding operation, insures proper density and increases the percentage of germination of seed over hand-seeding methods. The Super-Eco seeder has been popular in the peanut growing regions, though sharp price increases in the past two years may make it less so in future. OACV has a policy of selling the multiculteur and seeder as a package.

(e) Fungicide and Insecticide Seed Treatment: Mission IRAT studies show that most seedling diseases and soil insects can be controlled through the use of an inexpensive seed treatment mixed with the seed at planting. It is widely used by pilot farmers in Operations. Depending on soil moisture and field conditions, sorghum and millet stands (population of plants per ha) were reported to be 25-30 percent higher when seeds had been treated.

(f) Improved Crop Varieties: It has been demonstrated by Mission IRAT and pilot farmers that use of improved crop varieties as discussed above increases crop yields significantly. This may not be the case if improved seedbed preparation, weed control and seed treatment are not practised along with the use of improved varieties. Early-maturing maize varieties (85-90 days) appear to be better adapted to field cultivation than average or late-maturing varieties in the 800-1000 mm rainfall zone, according to Mission IRAT. The short-cycle varieties have other advantages as well: (1) they do not run the risk of damage (échuadage) during the hot month of September when the rains taper off, (2) they stretch out the cereals harvest, avoiding labor constraints, and (3) their use allows plowing under of stalks at the end of the rainy season.

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[8] A toolbar with attachments such as a plow, cultivator, spring-tooth harrow and peanut-lifter. It is the basic implement for animal-drawn cultivation. With this implement, all field operations except planting and harvesting can be performed.

(g) Crop Spacing: Operation Mil Mopti and Mission IRAT research have found that most soils in the zone can support higher populations of sorghum and millet than are commonly found. Poor stands are frequently the result of (1) wide spacing, (2) poor germination, (3) poor soil moisture, (4) seedling disease and (5) soil insect problems. Recommended plant population levels will vary depending on rainfall and soil fertility levels.

(h) Crop Rotations: Rotating sorghum millet and maize with peanuts and cowpeas helps maintain soil fertility and improves returns from fertilizer. Peanuts and cowpeas add tilth to the soil, improving yields of millet, sorghum and maize in the rotation. Field research at the PEP revealed in 1975 that when maize follows peanuts in the rotation, it always has yields superior to those of sorghum. This was found to be true on farms as well as in field trials.[9]

(i) Fertilizer: Manure and chemical fertilizers both increase crop yields. Almost all crops grown in Mali are responsive to phosphate fertilizer. A combination of nitrogen and phosphate has been shown to produce sizeable increases in yields for maize and sorghum.[10] OACV recommends use of 100 kg/ha of ammonium phosphate fertilizer (16-48-0) on maize at planting and 50 kg/ha of urea (46-0-0) during vegetative growth. The Operation is not so convinced about the profitablility of this dosage on sorghum, however, and has decided, we were told, to provide the fertilizer on credit for those who plan to use it on maize but to make cash sales only to those who want it for their sorghum crop. This raises the important question of the profitability, or lack thereof, of using chemical fertilizers on cereals in Mali. Readers wishing to explore the economics of the question will find a discussion of it in section I(K)3, page 98. With regard to the principal cash crops, peanuts and cotton, they are treated with standard doses of fertilizer: 65 kg/ha of single superphosphate for peanuts and 150 kg/ha of (18.5N + $31P_2O_5$ + $0K_2O$ + 8S + 0.26B) for cotton.

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[9] Mission IRAT, op. cit., p. PEP-1.

[10] The Mission IRAT report for 1975-76 states that the nitrogen-phosphate combination results in substantial increases in yields and remains economically profitable in spite of increased fertilizer prices. Op. cit., p. PEP-1.

(j) Pesticides: Cotton and peanuts are chiefly the crops on which insecticides, fungicides and herbicides are used for the control of insects, diseases, and weeds. On sorghum and millet a seed treatment is commonly used but spraying of sorghum and millet for grasshoppers (for example) is not usually done. Before one recommends the use of pesticides on crops other than cotton (where its use is well established), it is necessary to look at "pest management criteria", i.e. at what levels of infestation in relation to the time of year it is profitable to treat with pesticides. We will also mention here that, to cite two examples, in the Tériékolé Valley north of Kayes and in the Office du Niger, there has been a disturbing increase in the rodent population following the drought. Crops are seriously menaced, particularly flood-recession cereals in the Tériékolé. Rodenticides may not be the proper solution, but the problem is severe and growing. It will require action prior to the start of the 1977-78 crop year.

(k) Pit Silos: Pit silos were introduced in Mali as a program by the Peace Corps. Acceptance has been good where there has been a lack of feed supplies to maintain draft animals during the dry season. Silos vary in size, but are usually about 3 meters in diameter and 4 meters deep. When grass is abundant during the rainy season it is stored in the pit as haylage. Results appear to have been good and draft animals stronger for field work when spring rains begin. More quantitative analysis of pit silo efficiency compared to such alternatives as legume hay from peanuts or cowpeas would be most desirable.

J. EXTENSION SERVICES

Education and Training

Training for the agricultural service in Mali is administered by the Ministry of Higher Education and by the Ministry of Rural Development.

Senior and middle-level administrative and planning staff are trained in two coordinated but independent programs at the Rural Polytechnical Institute (IPR) at Katibougou. Senior-level personnel, Ingenieurs des Sciences Appliquées, follow a four-year, post-baccalauréat training program which permits them to specialize in agriculture, forestry, livestock or rural engineering. Middle-level staff, Techniciens Supérieurs, follow a four-year, post-primary training program with similar specializations. Although both programs are open by entrance examination, most students are "directed" into one cycle or the other following their primary or secondary education. As a result of the Government's policy to provide training (and subsequent employment) for students holding secondary level diplomas and of urgent demands for qualified agricultural personnel, both programs at the IPR have been expanding rapidly. (See Table 16.)

Junior-level agricultural staff, or moniteurs d'agriculture are trained in three Centres d'Apprentissage Agricole (CAAs) and two specialized agricultural training centers, one for rice production and one for vegetable production. Each CAA is associated with a state farm.

Admission to the CAAs is by a national examination open to young men between the ages of 17 and 20 who have completed 6 years of primary schooling. As the number of primary school students has increased, both the number and educational level of students taking the CAA admission examination have risen. In 1974 there were over 16 times more CAA candidates than available places. The average educational level of CAA students is now 8th and 9th grade, and some have even received the secondary-level DEF diploma.

The professional training period for a monitor lasts three years. Two years are spent at a CAA, and the third year is at one of the specialized centers or in the Operations. The best students are usually chosen to attend the specialized centers. Upon successful completion of their training, the students receive the Certificat d'Aptitude Professional Agricole, C.A.P.A.

Table 16. Rural Polytechnical Institute: Output and Projections of Malian Graduates by Specialization, 1974-1980

	Professional Level				Technician Level					
	Agric.	Livestock	Forestry	Total	Agric.	Livestock	Forestry	Rural Eng.	Total	Grand Total
1974[1]	29	11	9	49	24	10	19	9	62	111
1975[1]	40	15	11	66	60	14	17	2	93	159
1976[2]	49	35	27	111	50	14	19	10	93	204
1977[2]	39	28	12	79	75	35	44	9	163	242
1978[3]	--	--	--	--	--	--	--	--	--	---
1979[2]	56	43	20	119	95	52	35	15	197	316
1980[2]	81	62	31	174	137	75	50	25	287	461
Totals	294	194	110	598	441	200	184	70	895	1,493

[1]Actual figures

[2]Projections

[3]The absence of graduates in 1978 is the result of action taken four years earlier in lengthening the duration of training programs from three to four years.

SOURCE: Institut Polytechnique Rural, Katibougou

After one year of in-service training, the CAPAs are admitted into the civil service as moniteurs d'agriculture.

Design of the current study program for first and second year CAA students was part of two UNDP/ILO projects which also developed teaching materials and trained instructors and staff for the CAAs. Both first and second year classes spend about the same amount of time on the same subjects.

Organization of Extension Services

Staffing the field administrative structure with agricultural personnel usually follows the procedures of the Civil Service, which define responsibilities according to formal training received, as shown below.

Organizational Unit	Suggested Civil Service Scale
All operations except Operation Riz Ségou and Mopti:	
Region (or Zone for OACV)	A_1-Ingenieurs des Sciences Appliqués (ISA)
Secteur	B_2-Technicien Supérieur
Sous Secteur	B_1-Ingenieur or Conducteur[a]
Zone d'Expansion Rural	C -Moniteur d'Agriculture
Secteur de base	C -Moniteur or Encadreur Rural[b]
Operations Riz Ségou and Mopti:	
Zone	A_1-ISA
Casier	B_2-ITA or CTA
Sous Casier	C -Moniteur or
Cellule	Encadreur Rural

[a] This is a non-diploma civil service promotion category which is by professional examination only.

[b] The Encadreur Rural is not a Civil Servant, but a contract-hire employee subject to the Malian Work Code.

In 1973-74, the latest year for which complete staff statistics are available, there were 1,908 senior-, middle-, and junior-level staff employed under the jurisdiction of the Ministry of Rural Development. (See Table 17.) (A recent but incomplete up-date indicates that in 1976, 627 moniteurs and 1,326 encadreurs were employed excluding the zones outside the Operations.)

The Operations clearly employ the largest number of agricultural personnel.

Table 17. Distribution of Agricultural Personnel, 1973-74

	Staff Category					
Operation	ER	Monitor	CTA	ITA	ISA	TOTAL
OACV	309	78	37	13	1	438
CMDT	501	109	30	12	8	660
Haute Vallée	57	30	16	5	6	114
Riz Ségou	98	35	16	8	3	160
Riz Mopti	61	25	13	6	5	110
Mil Mopti	50	21	11	2	4	88
Subtotal	1,076	298	123	46	27	1,570
Outside Operations Region						
Kayès	56	21	10	4	-	91
Bamako	3	1	2	1	-	7
Ségou	103	22	16	1	-	142
Mopti	27	27	7	2	-	63
Gao	4	24	4	3	-	35
Subtotal	193	95	39	11	-	338
TOTAL	1,269	393	162	57	27	1,908

SOURCE: Ministry of Rural Development

While each Operation may establish its own criteria for evaluating personnel (production goals or agricultural material placed), all civil servants receive a common annual evaluation by their immediate supervisors. This evaluation is based on five criteria: professional comportment, self-discipline, method and organization of work, professional and general interests (culture générale).

In accordance with Civil Service statutes, agricultural personnel are eligible for the following discretionary allowances and bonuses:

	Moniteur	CTA	ITA	ISA
Compensation for Position		X	X	X
Compensation for Job Responsibility				X
Transportation Allowance	X	X	X	X
Per Diem Allowance	X	X	X	X
Production Bonus	X	X	X	X

The availability of allowances and bonuses is often determined by the extent of foreign financing of the Operation and the decision of the directors of the Operations. Foreign financing available to the Operations has made it possible for them to provide working conditions for agricultural personnel which are better than anything else available under the Ministry of Rural Development. The adverse effect of this situation on the Ministry's ability to supervise and coordinate the activities of the Operations has been mentioned in section I(F) above. On both equity and efficiency grounds the dichotomy is unfortunate.

Extension Programs

Based on the results of agronomic research performed by a research unit within an Operation or by one of IER's research institutes, the extension and training staffs in each Operation develop a yearly program of applied extension topics. Following specific crop calendars, the program is transmitted topic-by-topic, step-by-step down the extension hierarchy to the moniteurs and encadreurs through regularly organized in-service training sessions. Once the agents have received their training for each topic, they

begin a series of meetings with villages and individual farmers at the rate of approximately one extension topic per month.

Following this group contract, extension agents often visit pilot farmers, or "paysans suivis", on a regular basis. (Pilot farmers are usually larger farmers with sufficient labor, equipment and capital to implement the suggested agricultural improvements with relative ease and minimal risk. As used by CMDT, a paysan suivi is any farmer who accepts and applies any one of the CMDT-suggested improvements.) While in some cases, encadreurs and moniteurs may work on a one-to-one basis with more difficult farmers, it appears that they tend to spend a disproportionate share of their time with larger, more well-endowed farmers. As we contend in section II(F), this is partly because these farmers can have a substantial effect on production totals for the agent's area and partly because agricultural goods and services can be exchanged between them. The argument was also made to us that larger farmers provide a good means for disseminating improved techniques. We did not find it wholly convincing and believe it is a matter that merits more investigation.

Rural radio programming should be mentioned. It is an invaluable aid for agents in all of the Operations. OACV makes programming follow-up a special part of the work for each chief of a secteur de base, and Action Riz-Sorgho has sought to establish "radio clubs" as part of its extension program. Friday, the farmers' day of rest, is devoted to radio programming directed primarily to them. Each major Operation has the opportunity to broadcast, on a regular basis, information relevant to farmers within its zone. Furthermore, teams from Radio Mali often interview farmers and agricultural staff throughout the country. Without exception, moniteurs and encadreurs are enthusiastic about the utility of radio programming for their work. They note that it reinforces what they try to teach and gives farmers confirmation of what agents tell them.

Constraints and Problems

The absence of capable and qualified junior-level personnel is a serious constraint, if certainly not the only one, on the effectiveness of the

Operations. The 1974-1978 Plan estimated a minimum need for 1,683 moniteurs in order to implement proposed Plan projects. More recent projections based on an analysis of current hiring practices and proposed projects suggest a yearly average demand for approximately 200 CAA graduates from 1976-77 to 1984-85. In contrast, the CAAs are now capable of supplying a maximum of 90 moniteurs per year.

The quality of the training received by agricultural personnel also raises serious problems for the Operations. At Katibougou, classroom and living facilities are incapable of handling the increased enrollments. The equipment and books available are totally inadequate. Staff is lacking for several courses, such as animal production, horticulture, and plant protection. Other courses which need to be taught, such as economics, extension, and management and personnel practices, are not given sufficient attention. Furthermore, the staff/student ratio for some programs has reached an unteachable and "unlearnable" ratio of 1:75. Practical field work is limited and not properly supervised.

At the CAA training centers, all of the classroom and workshop buildings need repair and renovation. Most of the teachers are both undertrained and inexperienced. Rarely, if at all, do CAA teachers have any field extension experience. As a result, their teaching tends to reinforce the already bookish orientation of CAA training as well as perpetuate an elitist conception of the role of agricultural extension. Furthermore, the CAAs currently lack even the most basic teaching materials and supplies. There is no documentation for preparing lessons and no functioning library for trainees and staff. Moreover, most centers lack the transportation facilities necessary to take trainees on field trips.

While the extension agents working in the Operations receive adequate logistical support, only a few of the Operations provide and encourage advanced professional training for their extension personnel. Rarely do extension agents possess or have access to professional journals or documentation. The professional world of the agents is defined solely by the monthly mimeographed extension topics prepared by the Operation. Consequently, extension personnel tend to have relatively narrow and fixed views of their role, and their one-crop focus often prevents them from having

a real conception of the farmer's labor and land constraints.

Perhaps the biggest stumbling block to the effectiveness of the Operations is communication problems between many Malian farmers and agricultural agents. The latters' youthfulness, lack of field experience, and largely theoretical training often give rise to misunderstanding and distrust between the farmer and the agent. Faced with a "foreign" (nonvillage) young man in his mid-20s who is asking him to use a technique which may increase risks that are already high, the farmer is naturally very cautious about accepting advice. The farmer's caution may in turn be interpreted as obstinacy by the agent.

After three or four years of experience, however, most moniteurs and encadreurs begin to reflect a much higher sensitivity to the farmer's problems and an awareness that the farmers may have something to teach as well as to learn.

Despite the effectiveness of radio programming, problems often arise in those areas where the activities of two Operations overlap and where one Operation has less-developed programming. In these areas, farmers participating in the Operation without much programming have been noted to accept the agricultural advice and recommendations they hear most often, thinking that perhaps the recommendations for one crop are valid for other crops. Furthermore, radio programming does not effectively touch most farmers in the Fifth and Sixth regions of the country.

K. AGRICULTURAL CREDIT AND INPUTS

1. CREDIT

A state agency known as SCAER (Société de Crédit Agricole et d'Equipment Rural) has a monopoly on the distribution of farm implements, fertilizer, and pesticides. SCAER also provides short- and medium-term credit for farmers. It is important to note that credit is provided only through the development Operations. Some 90 percent of SCAER's sales are handled by the Operations, most of them by those that produce the country's major export crops -- OACV and Operation Coton (CMDT). The remaining 10 percent of SCAER's sales is made by its regional outlets on a cash basis.

SCAER's purpose has been stated as follows:

> "SCAER's objective is to place at the disposition of the rural population the means capable of encouraging the development of agriculture, livestock-raising, and fisheries. However, priority will be given to transactions in those zones where there is a valid and sufficiently dense extension service, able to provide technical guarantees for SCAER's activities."[1]

SCAER has no direct contact with the individual farmer but is nonetheless required to take all risks and cover the cost of damage, thefts or losses prior to the repayment of credit. The Operations serve as an intermediary but take no risks. SCAER considers this arrangement to be the cause of its most serious problems. On the other hand, we encountered farmers who said that they had been obliged by SCAER and/or an Operation to pay for equipment or fertilizer that was received damaged or spoiled.

Another problem, as seen from SCAER's point of view, is the tendency of Operations to use funds that they have collected from creditors at harvest time to help finance the buying campaign then in progress, rather than returning these funds directly to SCAER.[2]

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[1] Quoted in C.E.E.M.A.T./S.E.A.E.: Etude de l'Evolution des Facteurs de Production Mise en Place Pendant les Dix Dernières Années et de Leurs Effects. Paris, November, 1972, p. 4.

[2] Under the terms of an agreement between OACV and SCAER on October 10, 1974, OACV is supposed to make a report of collections each month and make an immediate deposit of 80 percent of that amount in SCAER's account at the Malian Development Bank (BDM). OACV, Compte Rendu de la Campagne Agricole 1974-1975, p. 46.

SCAER obtains its own financing from the Development Bank (BDM). The funds that it borrows are tied up for long periods, and the effective rates of interest it is allowed to charge fall well short of covering defaults, losses, and the cost of money. Payment to external suppliers was, at least in 1972, under difficult terms: 30 percent with the order, 20 percent at shipment, and the remainder within 90 days.[3] Almost all farm implements are now purchased locally from SMECMA (Société Malienne d'Etudes et de Construction de Matériel Agricole), a fabrication plant that began operation in 1974.

On the other hand, when seen from the point of view of extension agents, SCAER is widely considered to be a bottleneck. The Operations must place orders 10 to 14 months prior to the time that they can expect to receive the equipment, fertilizer or pesticides. The director of a smaller Operation told us, for example, that he had placed orders the previous August (which would be considered late on SCAER's timetable), had reconfirmed them in January, had been promised delivery time and again, and had finally received his order in mid-June, just as the major rains were beginning. His conclusion was that SCAER is not effective and is unable to render the services that the Operations require.

There seem to be two principal reasons -- the question of efficiency aside -- for SCAER's inability to deliver inputs on a more timely basis. The first arises from the fact that it is obliged to request international bids for imported inputs. Requests are published in June, orders are not placed until three months later, and goods do not start to arrive until October and November. SCAER attempts to deliver everything by the end of March so that distribution can be made to farmers before the crop season begins. It is not unusual, however, for deliveries of both imported and domestically produced inputs to arrive late as a result of the second reason, transportation problems, and/or to arrive in less than

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[3] C.E.E.M.A.T./S.E.A.E., op. cit., p. 5.

the quantity ordered.[4] The difficulties in transporting inputs to the places where they will be used is of course the inverse of the problem of getting output to market. In both directions the situation is getting worse as rapidly increasing demands are put on the existing system.

Delays in obtaining imports and in making shipments via the Dakar-Niger railway are perhaps the most serious. The cause is thought to be a lack of rolling stock. The Kayes sector of OACV finally received its shipment of seeders in mid-June 1976, at precisely the moment when peanut and maize growers needed them in their fields. By that date the sector still had not received its shipment of fungicide for peanuts.

The Dakar-Niger may not have foreseen the demands that would be put upon it by the agricultural sector. For example, imports of fertilizer by the railway have increased much faster than was expected only three or four years ago. The situation is the same with regard to the shipment of implements. SCAER placed supplementary orders for all four items of equipment made by SMECMA for delivery in 1976, and levels will be considerably higher again in 1977. The bottleneck is not in SMECMA's capability of producing this equipment but in obtaining the means of transport to get it into the hands of farmers.

Subsidies and Financial Problems

In addition to receiving criticism about its ability to deliver inputs, SCAER has had to face serious financial problems since 1973. A government policy of subsidization of inputs[5] has contributed greatly to SCAER's deficits. For the 1974-75 agricultural campaign the deficit was thought to have been as much as MF 600 million ($1.26 million). The agency's income from interest is negligible. Its main sources of income are taxes levied on the sale price of cotton and peanuts. In 1974-75 these levies were MF 11,500 per ton of seed cotton and MF 8,936 per ton

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[4] SCAER is supposed to make deliveries at the sector level, but OACV has on occasion been obliged to use its own trucks to deliver inputs to certain sectors. It bills SCAER for costs.

[5] Covered in part by FAC, FED, and FAO.

of unshelled peanuts. There is also a special tax on peanuts as the result of a decision made in 1972 by the Ministry of Finance and the Office of Price Stabilization that MF 55.7 million in credit defaults in the OACV zone from 1968 to 1972 would be recovered by means of a tax on peanut sales.[6]

The clear effect of these levies is to make the poorer farmers pay for a substantial portion of the subsidies given to, and the bad debts of, the richer farmers. The inequity of such a system is more apparent in the OACV zone, where the levy is 22 percent of the producer's price (the special tax not included) and where far fewer farmers use animal traction and fertilizer, than in the CMDT zone, where the levy is 15 percent of the price. As will be shown below, in the OACV zone the default rate for equipment is much higher than it is for fertilizer or fungicide. Yet in 1973, 1974, and 1975, only about one percent of the farmer units in the zone were able to purchase equipment on credit each year. The irony is that the cost of providing credit was paid, not by the small percentage of farmers who could have afforded an appropriate interest rate, but by the vast bulk of farmers who cannot afford down-payments for implements and who gave up to SCAER a substantial portion of what they might have earned from a kilo of peanuts.

The subsidy on equipment was removed in 1976, while subsidies on fertilizer and pesticides were reduced. The resulting increases in price have been compensated to some extent by easier credit terms. Those farmers who do not yet have implements but are in a position to make the down-payment will pay a price that reflects real costs more accurately but will still receive hidden interest-rate and ease-of-default subsidies at the expense of the poorer farmer.

The poorer farmer who would like to use animal traction is now faced with a situation considerably worse than it was as recently as 1974. He continues to subsidize his more advanced colleagues as described above, and he also faces much higher costs both for equipment and for

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[6] OACV, op. cit., p. 49.

a trained pair of oxen. The price of the latter has risen from 50,000 to 75,000 MF in 1974 to between 120,000 and 150,000 MF in 1976. Unfortunately, there is no SCAER credit for draft animals.

Some of our discussions with extension agents indicate that the high cost of a pair of oxen and lack of credit for their purchase may have become a stumbling block to the expansion of animal traction. We discuss further in section II(B), the impact of the combination of increased input costs and stagnant output prices. It is sufficient to point out here that in addition to severe problems in the administration of the credit that it now extends, SCAER also needs to face the issue of expanding its facilities to include such things as draft animals, motor pumps, livestock feed, and small milling machines.

The Operation as Intermediary

A clearer picture of the situation at the level of the Operation might emerge from an examination of OACV's credit picture. It should be noted that SCAER gives to each Operation the discretion to fix credit terms within the national standards. Until 1976, for example, medium-term credit for implements could not be extended for more than two years. Now that subsidies have been removed, the term has been extended to three years.

To be eligible for credit to buy a multiculteur and seeder, a farmer is required by OACV to (a) have at least one trained pair of oxen, (b) have derooted (déssoucher) at least two hectares, (c) have 3 yokes (for peanuts, millet and corn) and (d) make a commitment to follow OACV's recommended practices. OACV then requires a down payment of one-sixth of the credit price[7] of the implement, one-sixth at the following harvest, one-third at the second harvest, and one-third at the third harvest. The terms previously in effect were: one-third down, one-third at the first harvest, and one-third at the second. Since the price of a multiculteur when sold on credit, for example, has gone from 43,200 MF

[7] In 1972 credit and cast sales were made at the same price "to simplify the accounting of the Operations and to avoid certain illegal practices at the warehouse level." C.E.E.M.A.T./S.E.A.E. op. cit., p. 7. Credit sale prices are now 6.25 percent higher than cash sale prices.

to 85,000 MF, the farmer now pays approximately the same amount in the first year, twice as much the second, and an amount equivalent to two-thirds of the old price the third year.

Credit for fertilizer and selected seed is short-term, extended until harvest. Seed credit is extended from OACV's own funds rather than SCAER's. Selected seed purchased for cash costs 55 MF/kg; on credit it costs 65 MF/kg. OACV sells fungicide only for cash.

Total OACV figures for the 1974-75 year[8] reveal that equipment credit was reimbursed at a level of 40.5 percent rather than the 66.7 percent level required by the terms then in effect. However, performance is even less impressive since reimbursements include those for credits extended in previous years. Season credits for fertilizer and seed, which are normally collected before other credits by OACV agents, were 78.6 percent reimbursed. The highest percentages in both categories were achieved by the Ségou "zone", which had been brought under OACV only at the beginning of the 1974-75 crop year.

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[8] OACV, op. cit., pp. 47-49.

2. AGRICULTURAL IMPLEMENTS

A primary element in the Malian Government's efforts to increase crop production and productivity is the spread of animal traction techniques and a rise in the percentage of total cropland under the plow. Animal traction is seen as a prerequisite to the effective use of other improvements, all of which promise increasing production and higher productivity from Malian labor and land.

A great deal of progress has already been made. In fact, a study done in 1972 remarked that:

> Mali appears to be a country that has decisively opted for animal traction. Overall, it has probably the most mechanized farming population in West Africa. We have seen that prices and terms, which are often hard to meet, do not keep farmers from purchasing equipment, even in the zones outside the Operations. This demonstrates a definite attraction for the use of agricultual equipment.[1]

Mali's favorable position compared to other countries in the Sahelian zone of West Africa is confirmed by recent FAO estimates. The Prospective Study lists Mali as having more than half of the plows, about one quarter of the ox-carts, and some 40 percent of the draft animals that were found in 1975 in all seven of the Sahelian states combined. In fact, FAO believes that Mali's lead had been even greater. The study states that the number of plows in Mali fell from 90,000 in 1973-74 to 77,272 in 1975 and that the number of ox-carts was reduced from 36,000 to 21,802.[2]

These figures are not inconsistent with the findings of the CNPER. As we have done often in this report, we turn to the CNPER for benchmark figures that appear to have estimated the actual situation in rural Mali, at least for one year, with as much accuracy as, or more than has been attainable through other means. The CNPER figures for plows

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[1] C.E.E.M.A.T./S.E.A.E., Etude de l'Evolution des Facteurs de Production mise en place pendant les Dix Dernières Années et de leurs Effets, November 1972, p. 41.

[2] FAO, Etude Prospective pour le Développement Agricole des Pays de la Zone Sahelienne, 1975-1990. Rome, 1976, vol. I, p. 93. No explanation for the decline appears to be given.

and other major implements in 1971-72 are shown in Table 18 by rural Zone. At that time Malian farmers had 88 thousand plows -- one plow for every 21 hectares cultivated.[3] Alternatively stated, given the average cultivated area per farm of about four hectares, about 20 percent of the farmers were equipped with a plow.[4] Other equipment on farms included 5,500 harrows, 524 seeders and 25,000 carts.

Unlike the FAO Prospective Study, however, we found several indications that the 1972 levels have increased substantially rather than declined.

Table 18. Area and Animal-drawn Implements by Rural Zone, 1971-72.

Zone	Cultivated Area (Ha)	Number of Implements in Use			
		Plows[a]	Harrows[b]	Seeders	Carts
Sud	611,643	29,080[c]	2,151	-	9,495
Centre & Ouest	359,850	18,712	1,267	347	7,991
MV Niger-Bani	94,173	6,912	1,352	-	3,152
Delta	120,800	14,928	368	-	655
Haute Vallée	61,058	2,631	533	80	947
Lacustre	89,500	700	-	-	-
Sahel	169,166	10,077	136	97	920
Office du Niger	41,401	4,484	3,122	-	1,358
Séno-Dogon	259,387	516	-	-	526
6th Region	42,820	-	-	-	-
Totals	1,849,798	88,050	5,547	524	25,044
Ha/implement		21	334	3,530	74

[a]Includes multipurpose toolbars with attachments (Multiculteurs).

[b]Includes light cultivators (hoes).

[c]This is probably an underestimation as only the plows found on the 7,700 ha of improved farms in the cotton Operation (CMDT) are included.

SOURCE: CNPER, Situation de l'Economie Rural Malienne en 1972, p. 260,264.

[3]This estimate is probably conservative as the number of plows listed for the Zone Sud includes only those plows owned by farmers in the CMDT Operation Coton program.

[4]Some farmers have more than one plow, so the proportion equipped may be somewhat overestimated here.

Using data only from Operations, for which better data are available and within which most implement purchases occur, we estimate an increase of 23,000 plows (including multiculteurs[5]) between 1971-72 and 1976-77. This would imply 65,000 plows on farms within Operations and 111,000 on all farms. As area cultivated has changed little, the estimated area cultivated per plow is 17 hectares.

Using the same technique, the current supply of carts on farms is estimated to be 21,500 within the Operations and 33,000 throughout the country. The harvested area per cart estimate falls to 56 hectares, as compared to 74 in 1971-72.

Evidence from CMDT suggests that these estimates may even be conservative. According to the 1974-75 annual report of CMDT, there were more than 50,000 plows and multiculteurs in use within Zone Sud during 1974-75.[6] Thus the increase for CMDT alone (see the 1971-72 estimate in Table 18) was about what we have projected for all the Operations. CMDT also lists 14,000 carts, an increase of 4,500 over the 1971-72 estimate. This would account for one-half of the projected increase.

Information from OACV shows that multiculteurs and seeders, if not carts, have been placed in the hands of farmers in the Operation in greater numbers in the past three years than they had been in the past.

Table 19. Placement of Equipment by OACV, 1969-70 to 1975-76

	Multiculteurs	Seeders	Ox-carts
1969-70	79	0	132
1970-71	89	81	157
1971-72	466	213	395
1972-73	694	523	599
1973-74	1,098	1,126	120
1974-75	905	887	180
1975-76	1,208	1,169	980
Total:	4,528	3,997	2,513

SOURCE: OACV, Compte Rendu, pp. 129-133; OACV.

[5] The multiculteur with attachments is the basic implement for animal-drawn cultivation. With this implement, all field operations except planting and harvesting can be performed.

[6] CMDT, Rapport Annuel, Campagne Agricole 1974-75 en Zone Cotonnière. Annex, first table. Some 7,651 multiculteurs and 809 plows were taken by CMDT farmers in the two years, 1974-75 and 1975-76 alone, according to Afrique Agriculture, No. 6, Feb. 1976, p. 37.

Other evidence suggesting that a relatively rapid rate of adoption existed in 1975-76 were given by the head of the manufacturing firm for agricultural implements, SMECMA. He told us that over the 1975-76 season SMECMA delivered to SCAER 6,500 plows, 9,000 multiculteurs, 3,500 seeders and 7,000 carts. Barring a rapid inventory build-up which we did not perceive, these implements have been taken up by farmers. (He also told us that orders from SCAER this year are for 12,000 plows, 13,000 multiculteurs and 11,000 carts. He expects to exceed these quantities.)

In any case it is clear that adoption of animal traction has moved rapidly in Mali -- and has accelerated in recent years. The total number of plows and multiculteurs in use is over 100,000, possibly as many as 130,000. Thus about one fourth of Mali's farmers are already equipped with the basic element for modernization. And at the rate of adoption that has prevailed in the last two years, one half of the farmers could be equipped within five to eight years. Of course one should be cautious about offhandedly projecting rapid change; sharp rises in prices for equipment and draft animals, in combination with unchanged producer prices, may already have changed the picture considerably.

Yet change at even one-half the rate that appears possible could put serious strains on the ability of the government and the private sector to cope. A rate one-half the current rate is not out of the question if the policy of allowing farm equipment investment to be financed by farm profits could be fully implemented. The proviso is an important one since implementation conflicts with the maintenance of consumer prices and the attainment of other government objectives. We wish only to note here that if the government were to take an easier stand on producer prices, it should be prepared to respond quickly to the virtual explosion in production that could occur.

The implications of this potential revolution in farming methods are large: for capital needs; for work animal and associated feed crop requirements; for auxiliary inputs and services; for production

and productivity; and for the quality of rural life.

Table 20. Evolution of Farm Adoption of Animal-Drawn Implements by Operations, 1968-69 to 1971-72

Operation	Hectares per plow or multipurpose toolbar				Area 1971-72 (1000 ha)
	1968-69	1969-70	1970-71	1971-72	
Cotton (CMDT)	3.6	3.0	2.5	2.6	77
Riz Ségou		4	4	4	11
Riz Mopti	6.5	5.1	4.8	1.9	50[a]
Office du Niger	4.6	4.6	7.7	6.8	30[b]
Peanut (OACV)		956	1166	198	92
Haute Vallée	16.4	16.1	14.3	15.3	33

[a]This area includes land not in the Riz Mopti polders.

[b]WARDA uses a figure of 38,534 ha for 1971-72; but some portion of this was farmed directly by the Office with mechanized means.

SOURCE: CNPER, Situation de l'Economie Rurale Malienne en 1972, pp. 266-269.

3. CHEMICAL FERTILIZER

As is the case with so much data on the agricultural sector, statistics on the use of chemical fertilizer are difficult to pin down. For example, the long time series of the "Etude de l'Evolution des Facteurs de Production" agrees hardly at all with the shorter series found in the CNPER final report. Since data from OACV tend to support those of CNPER, we will rely on that source once again.

Even if the statistics are of dubious precision, they tell a clear story. Prior to 1970 chemical fertilizer was used almost exclusively on the export crops -- cotton and peanuts. The amounts used rose from negligible quantities at the beginning of the 1960's to some 10,000 T in 1971. By 1970 fertilizer had been introduced on rice both in the Office du Niger and in the controlled submersion zones. It had also begun to be used on tobacco in the Haute Vallée and on vegetables at Baguineda.

The following table shows how fertilizer consumption more than doubled between 1969 and 1970.

Table 21. Fertilizer Consumption by Operations, 1968-69 to 1971-72
(metric tons)

Operation	1968-69	1969-70	1970-71	1971-72
CMDT	1,680	1,890	5,838	7,704
OACV	320	371	1,255	1,521
Office du Niger:				
(a) cotton[a]	291	260	-	-
(b) rice	9	235	457	486
Riz Ségou	-	-	31	20
Riz Mopti	-	40	23	16
Haute Vallée	-	27	401	555
Baguineda	-	19	50	85
Zones outside Operations	n.a.	n.a.	n.a.	32
Total:	2,300	2,842	8,055	10,419

SOURCE: CNPER, La Situation de l'Economie Rurale Malienne en 1972, pp.272-275

[a]The Office du Niger ceased cotton production in 1970.

Thereafter, continued promotion of fertilizer use by CMDT and OACV pushed Mali ahead of most of its neighbors. The FAO has estimated that by 1975 Mali accounted for 30 percent of the fertilizer nutrients being used in all seven Sahelian countries. Senegal, with 54 percent of the total, was using considerably more, but the other Sahelian states were using far less.[1]

Peanuts

The progression with which fertilizer applications on peanuts in the OACV zone have increased since the Operation's inception is shown by the following table.

Table 22. Fertilizer Use on Peanuts in OACV Zone, 1967-68 to 1975-76 (metric tons)

Year	Amount	Area Treated (ha)	Total Area Cultivated	Percentage of Total Area Treated
1967-68	119	1,824	46,240	4
1968-69	320	4,925	48,650	10
1969-70	371	5,704	71,630	8
1970-71	1,242[a]	19,107	102,600	19
1971-72	1,521	23,403	92,365	25
1972-73	1,978	30,438	96,000	32
1973-74	2,622	40,346	89,660	45
1974-75	2,357	36,260	107,300	34
1975-76	3,438	52,887[b]	n.a.	n.a.

SOURCE: OACV, Compte Rendu, p. 126, 135.

[a]This one figure does not agree with CNPER; like the others, it was obtained by multiplying the surface treated times 65 kg, which is the weight of a sack of single superphosphate, the recommended dosage per hectare.

[b]1975-76 figure from OACV.

[1]FAO, Etude Prospective, Vol. I: Rapport Principal, p. 93.

The intriguing drop of nine points in the percentage of total OACV peanut cropland fertilized in 1974-75 could be explained in part by the fact that the OACV zone was expanded in that year. It cannot be explained by rising prices since fertilizer cost the same in 1974 as it did in 1971. (See Table 27, page 133). In fact, the OACV has chosen to explain it as follows. "This reduction is explained basically by the low purchasing power and the level of debt of farmers in the zones devastated by the drought."[2] By the following year -- the second year after the end of the drought -- these constraints apparently no longer applied. We do not have a figure for the area cultivated in 1975-76, but if it remained constant the percentage of the total area that was fertilized rose 15 points to 49 percent, the highest ever, despite the rise in the price of a sack of single superphosphate from 3,500 MF to 3,935 MF.

Even though the price of a sack has been rounded off at 3,900 MF, there were clear indications in June 1976 that a decrease in fertilizer use could be expected in 1976-77. The Kita sector anticipated its farmers would use 15 to 20 percent less in 1976-77 than they had used in 1975-76. The Kolokani sector was also expecting to distribute less fertilizer. Recalling that peanut farmers, at least in the Kita sector, were said to have had strong (but unfulfilled) expectations of a producer's price rise in the record year for fertilizer applications, we do not find it surprising that fertilizer purchases were apparently headed down the following year, the price rise still unattained.

OACV uses 65 kg of single superphosphate (0-21-0) per hectare of peanuts, recognizing that agronomically it is not the ideal formula. The Operation has asked for research to determine a better one. Meanwhile it continues with "single" on the grounds that it allows the farmer to get the maximum increase in production with the minimum of

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[2] OACV, Compte Rendu, p. 32.

investment.[3] Roger Montgomery noted that at 1976 prices single superphosphate is much more expensive per unit of delivered nutrients than triple superphosphate: 350 MF/kg compared to 254 FM/kg. He remarked that in light of high transport costs it would make more sense to apply smaller doses of triple superphosphate.[4] Even using single, there seems little question that chemical fertilizer applications on peanuts are economically worthwhile. This can be said without bothering to calculate the residual effects on the cereals planted next in the rotation. The study of the "Evolution des Facteurs de Production" cautiously used a figure of 250 kg/ha for the increase in peanut yield from the application of 65 kg of single superphosphate per hectare, provided it were used along with other improved techniques.[5] At 1976-77 prices such a yield would provide the peanut farmer with an income of 10,000 MF/ha for an outlay of 3,900 MF/ha. In other words, if the response to single superphosphate is as indicated, it takes 1.5 kilos of peanuts to buy one kilo of fertilizer, and the fertilizer will produce almost 4 kilos of peanuts.

We discuss below the question of fertilizer subsidies, which the government reduced considerably in 1976. At this point we note only that the current subsidy on single superphosphate (5 percent) is the lowest of the fertilizer subsidies and not one that causes any significant price distortion.

Cotton

Cotton farmers in Operation Coton (CMDT) often use both chemical

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[3]The 1974-75 annual report of OACV concludes: "The very high cost of fertilizer combined with producer prices that are too low do not allow any profit from using normal amounts of chemical fertilizer. The high-yielding varieties that are used are very demanding of the soil and step up the process of impoverishment. Spreading weak dosages of fertilizer as we do only serves to slow down this process of soil degradation." OACV, op. cit., p. 34.

[4]Roger Montgomery, op. cit., p. 31.

[5]CEEMAT/SEAE, op. cit., p. 21.

and organic fertilizer on their fields. It is not clear from the 1974-75 annual report on the cotton zone how much hectarage is fertilized with both. Data on the use of either chemical or organic show that while there was not much change in the total fertilized area between the last year of the drought and the first year after it, the second post-drought year produced a sharp expansion. Expressed as a percentage of the total area seeded, however, the change has not been great.

Table 23. Cotton Cropland Fertilized, 1973-74 to 1975-76.
(hectares)

	1973-74	1974-75	1975-76
Total Cotton Area seeded (CMDT)	69,456	68,059	87,411
Chemical fertilizer: area	47,229	47,446	63,367
percent of total:	68%	70%	72%
Organic fertilizer: area	n.a.	19,187	24,944
percent of total:	--	28%	29%

SOURCES: Ministère de la Production, Rapport Annuel: Campagne Agricole 1974-75 en Zone Contonnière, p. 24, Annexes; Afrique Agriculture, No. 6, Feb. 1976, p. 37.

The volume of fertilizer used on cotton cropland has progressed from 1,680 T in 1968-69 to 7,704 T in 1971-72 and to approximately 12,000 T in 1976-77. We were informed by SCAER that CMDT had ordered the last-named amount for the current year and had more than doubled it for 1977-78 with a request for 25,000 T.

The recommended dosage for cotton has been a mixture of 100 kg of ammonium phosphate and 50 kg of ammonium sulfate per hectare (18.5 N + $31P_2O_5$ + $0K_2O$ + 8S + 0.26B). Between 1970 and 1973 this would have cost the farmer 7,950 MF/ha. One French study in 1972 estimated that in association with four insecticide treatments such an application would increase seed cotton yield by 250 to 400 kg/ha.[6] At the

[6] Ibid., p. 21, 23.

producer's price then prevailing, the farmer would have increased his revenue by 12,500 to 20,000 MF/ha. Another study done the same year calculated that the increase might be larger: 150 kg/ha of the mixture could add 482 kg of seed cotton per hectare and produce 24,100 MF in additional revenue.[7]

Since these studies were done the price of the cotton mixture has doubled from 55 MF/kg in 1974 to 110 MF/kg in 1976, and the producer price of seed cotton has been raised by 50 percent from 50 MF/kg to 75 MF/kg. If we use a conservative figure of 300 kg/ha for increase in yield from the application of 150 kg/ha of cotton mixture, the farmer would get increased revenue of 22,500 MF/ha for an outlay of 16,500 MF/ha. The return on fertilizer investment is not as good as it is for peanuts, but apparently it is high enough for many farmers to produce the sharp expansion in cotton fertilizer use that has occurred over the past two years.

As is the case with peanuts, the bonus from the application of cotton fertilizer is the residual effect on the cereals that follow in rotation. As the SEAE/SEDES study remarked about its sample of cotton farmers, "They generally do not calculate the effect of fertilizer on cotton, but they are aware of the residual effect obtained on cereals the following year."[8]

Coarse Cereals

This point brings us to the question of direct fertilizer use on coarse cereals. With the recommended dosage of 100 kg/ha of ammonium sulfate to be applied at planting and 50 kg of urea during vegetative growth, fertilizer use on cereals can be prohibitively expensive for the Malian farmer who sells little of his cereals production. At 1976 prices, the ammonium phosphate alone costs 9,500 MF/ha. One school of thought in Mali maintains that at these prices chemical fertilizer is not productive, except on maize. OACV, for example, was

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[7] SEAE/SEDES, "Analyse des Effets des Facteurs de Production dans l'Opération Coton Sud - Mali", 1973, p. 14.

[8] Ibid., p. 14

obliged by late deliveries of ammonium sulfate in 1974-75 to limit application to only 23.5 ha of millet fields. Its annual report concluded that "the profitability of fertilizer on cereals is slight."[9] In the following year, 1975-76, the hectarage was expanded almost 100-fold to 2,200 ha, but OACV's conclusion was much the same. We were informed by the Operation's Technical Director that the constraint to using chemical fertilizer on cereals is the cost. The Operation has therefore decided to concentrate on using chemical fertilizer on maize, where yields are higher, rather than on millet and sorghum. In order to maximize the probability of profitable use on maize, OACV will require in 1976-77 that a farmer buying fertilizer on credit for use on maize (a) demonstrate to his extension agent that he has a good field, (b) have it measured, and (c) use organic fertilizer to improve soil structure.

In fact, the OACV sector chief at Kayes believes that in his part of the zone maize yields are better when organic rather than chemical fertilizer is used. He estimates the maize yeilds can reach 4 T/ha with applications of animal manure compared to 2.5 to 3 T/ha with the recommended dosage of chemical fertilizer.

In the Zone Sud, CMDT relies more on organic than on chemical fertilizers for coarse cereals. The 1974-75 annual report indicated that 7,412 ha of millet and sorghum and 3,538 ha of maize received organic fertilizer in that crop year, while 560 ha got a complete dose of chemical fertilizer (presumably including ammonium phosphate or the cotton mixture) and 3,485 ha received at least one application of urea.[10]

The crucial question, of course, is what kinds of yield increases can be expected from coarse cereals with the recommended chemical fertilizer applications. A comparison of Roger Montgomery's

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[9] OACV, op. cit., p. 32.

[10] Ministère de la Production, Rapport Annuel: Campagne Agricole 1974-75 en Zone Cotonnière, Annexes, Table 15.

regression analysis and our own estimates (found in Appendix C) for millet and sorghum shows the following.

Table 24. Expected Millet and Sorghum Response to Recommended Fertilizer Applications (kilograms per hectare)

	Sorghum		Millet		
Yield	Montgomery	CRED[a]	Montgomery	CRED[a,b]	CRED[a,c]
no fertilizer	954	1,400	541	900	1,300
100 kg/ha ammonium phosphate or cotton mixture + 50 kg/ha urea	1,511	1,800	1,137	1,400	1,700
Increase in Yield	557	400	596	500	400

[a]non-fertilizer yield based on use of all other recommended practices.

[b]for 600-700 mm rainfall zone.

[c]for 900-1100 mm rainfall zone.

SOURCES: Roger Montgomery, "The Economics of Fertilizer Use on Sahelian Cereals: The Experience in Mali and Upper Volta," Table 23 and 25; Appendix C.

The next table shows what incremental costs and revenues would result from Montgomery's and our calculations at 1976 prices.

Table 25. Profitability of Fertilizers on Coarse Cereals (MF per ha)

	Sorghum		Millet		
	Montgomery	CRED	Montgomery	CRED[a]	CRED[b]
Revenue increment:	17,824	12,800	19,072	16,000	12,800
Fertilizer cost:					
(1) cotton mix + urea	15,600	-	15,600	-	-
(2) ammonium phosphate + urea	-	14,100	-	14,100	14,100
Net Revenue	+2,224	-1,300	+3,472	+1,900	-1,300

[a]600-700 mm rainfall zone.

[b]900-1100 mm rainfall zone.

The results of the above calculations appear inconclusive. Fertilizer on millet or sorghum makes sense for the farmer who can expect to obtain incremental yields at least as good as those from Montgomery's regressions and who can also expect to sell his additional production in its entirety at no less than official prices. This is a tall order. The vagaries of climate and cereals markets are such that it is a large risk to run for small gain.

Maize is somewhat more promising. We estimate that the application of 100 kg of ammonium phosphate at planting and two applications of urea totaling 150 kg during vegetative growth will double average yields from 1,400 kg/ha to 2,800 kg/ha. This would produce additional revenue of 44,800 MF/ha for an outlay of 23,300 MF/ha.[11] The better responsiveness of maize is sufficient to make it the preferred of the coarse cereals for direct chemical fertilizer application. OACV, as we have said above, is concentrating on it. No doubt this is in some part because fertilizer will tend to be used by the larger, better equipped farmers who work more closely with extension agents. Because of the difficulty of grinding corn, farmers are said to be more willing to sell it and to buy millet or sorghum with the proceeds. Their closer contact with agents may also increase the probability of sale at the official price. For all these reasons, it is not surprising that among the coarse cereals, OACV has chosen to emphasize fertilizer use on maize alone.

Rice

Chemical fertilizer has been used more on rice in the Office du Niger than it has been in the Rice Operations, as indicated by Table 21. In the Office a light application of 50 kg/ha of urea is used on about one-third of the cultivated area. Officials of the Office say that there used to be strong resistance to fertilizer on the part of tenant farmers but that they now request it more and more. In the Rice Operations, on the other hand, the unhappy experience of the drought years, when some four-fifths of the planted fields in Riz Ségou were not flooded, has apparently caused understandable reluctance to apply fertilizer on the polders. In fact we were informed by Riz Ségou

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[11] The extra nitrogen from this dose is more than that being recommended by the Operations.

that because weeds are such a probelm it does not recommend fertilizer except for pilot farmers who can weed between rows with a multiculteur before flooding. These farmers usually use 50 kg/ha urea.

Our calculations are that applications of 100 kg/ha under the partial irrigation conditions of Operation Riz Ségou would increase yield by 500 kg/ha (Table x, Appendix C). This would increase farm revenues by 20,000 MF for an outlay of 9,200 MF/ha. Taking into consideration the risks of inadequate of non-existent flooding, our yield calculations are on the conservative side. Montgomery comes up with much higher yields from the use of IRAT data, which leads him to question the relevance of test plot results for irrigated rice. In any case, he estimates that a "light dose" of 100 kg/ha cotton mixture and 100 kg/ha urea will produce substantial increases in revenue to the producer and that a heavier dose is even more profitable.[12]

Fertilizer Prices

In 1974 Malian farmers were paying only 50 to 68 percent of the cost of fertilizers to the distributing agency, SCAER.[13] A portion of this subsidy was paid for by the European Development Fund, but most of it was absorbed by the Malian government. When world prices rose sharply, it was reflected in the fertilizer prices charged to Malian farmers in 1975. The cost of urea to SCAER went from 105 MF/kg to 246 MF/kg; other common fertilizers rose in like manner. Prices to the farmer were raised but not in proportion, making the subsidy larger than ever. Happily, world prices fell and reduced costs for 1976 fertilizers considerably. At the same time, the Malian government raised prices paid by farmers for the second straight year, and the combined effect was to reduce the subsidy level substantially. Subsidies on urea and single superphosphate are now quite low, with those on the cotton mixture and ammonium phosphate somewhat higher. (See Table 26)

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[12] Montgomery, op. cit., pp. 65-72.

[13] For example, the cost of ammonium phosphate to SCAER was 80 MF/kg, and the farmer paid 40 MF/kg. For urea the figures were 105 MF/kg and 65 MF/kg, respectively. See CNPER, "La Politique des Prix et les Coûts des Produits Agricoles", Annexes, March 1974, p. 28. The "official price of single superphosphate was 40 MF/kg, but OACV actually charged 54 MF/kg to peanut farmers. The cost to SCAER was 80 MF/kg. In 1976 the official and the actual OACV prices were finally the same: 60MF/kg. See Table 27, page 133.

Table 26. Price structure for two types of mineral fertilizer for the 1975-76 and 1976-77 agricultural campaigns in Mali (MF/kg)

	1975-76		1976-77	
	Urea	Ammonium Phosphate	Urea	Ammonium Phosphate
Price CIF Dakar	200.00	166.80	75.72	112.85
Freight Dakar-Bamako	17.00	60.00[1]	23.40	23.40
Price CIF Bamako	217.00	226.80	99.12	136.25
Transport, interior	12.00	12.00	1.49	2.04
Mgmt fees (costs)	6.89	4.38	3.47	4.77
Financing costs	8.45	5.36	2.97	4.09
Sale commision	3.15	2.00	4.96	6.81
Real cost of supplying (Prix de revient, total)	246.49	250.54	112.01	153.96
Selling price	85.00	55.00	92.00	95.00
Subsidy, of which	161.49	195.54	20.01	58.96
real subsidy	132.00	171.80	7.12	41.25
SCAER charges	29.49	23.74	12.89	17.71

[1]This high freight cost is explained by the need to ship by boat from Dakar to Abidjan and thence by truck to Bamako, because of priority given to cereal shipments on the Dakar-Bamako railway.

Note: 1974-75 Prices		Urea	Ammonium Phosphate
	SCAER's cost	105 MF	80 MF
	Sale price	65	40
	Subsidy	40	40

SOURCE: Ministère du Developpement Rural, Stock de Securité, p. 39.

L. MARKETING

Cereals

The basic element of the official cereals marketing structure in Mali is OPAM (l'Office des Produits Agricoles du Mali), created in 1965[1]. OPAM is a state enterprise which nominally has a monopoly for domestic cereals marketing at all levels and for cereals, fresh fruit and vegetable exports and imports.

The personnel structure of OPAM includes administrative and financial staff at the national and regional levels, and, usually, a single manager at the level of each cercle. Altogether OPAM employs 750 persons. Thirty-eight percent of the personnel are employed in Bamako at OPAM's administrative offices and major depot.

Although OPAM owns some trucks, all of small size (5-10 ton), in general it relies on private truckers and the state trucking firm, Compagnie Malienne de Transports Routiers, for movement of grain among storage points. Some grain also moves by barge on the Niger during the flood season, particularly from Mopti to Gao. Storage facilities of OPAM total 91,500 tons concentrated in the regional capitals (see Table 14). Bamako, Mopti, and Gao together account for about 50 percent of the total OPAM-owned storage capacity.

OPAM cereals purchases are financed by the Development Bank (BDM). Funds are advanced to OPAM, one-half at the beginning of the buying season, one-half about three months later.[2] OPAM's operations are financed by

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[1]This description of OPAM's structure and operations is based largely on: IDET-CEGOS, Etude des Structures de Prix, vol. II, pp. 1-9 and 18-29. While in Mali we were kindly permitted to consult this interesting study. It should be noted that its findings and conclusions had not yet been approved by the Malian government.

[2]This information from the CEGOS report (p.5) may or may not conflict with a report we got from a manager of one regional cooperative that only one-fifth of needed funds are received at the beginning of the buying season, which always starts late because of the lateness of funding. The remainder (although not always as much as authorized) comes in two installments. Evidently funds for the season's purchases are held back within OPAM itself or by the administrative officials who transmit funds from OPAM to the cooperative.

a capital fund which is replenished by a 5000 MF/ton management fee in the cereals barème and, because of persistent deficits, by government subsidies.

Marketing procedures for cereals are as follows.

Purchases Outside Operations

Money for purchases from farmers is advanced through the Commandant de Cercle and the Chef d'Arrondissement to the cooperative. The advance includes allowances for transport from the village to the arrondissement and for the cooperative's overhead and transport costs. These allowances were established by the 1974/75 barème at 2150 MF and 2900 MF per ton, respectively.

Barème for Millet, 1974-75

Producer price	32,000	
Transport costs (producer's)	2,150	
Transport costs (cooperative's)	2,900	
Purchase cost to OPAM	37,050	
Losses	800	
Finance Costs	2,130	
OPAM tax (management fee)	5,000	
OPAM's transport costs	5,000	
Wholesale price	49,980	(rounded to 50,000)
Retail margin	1,500	
Retail price	51,500	

Source: IDET-CEGOS, Etude des Structures de Prix, vol. II, p. 25.

Farmers deliver their quota to the arrondissement and are paid the official producer price, currently 32 MF/kg, plus, in theory, the transportation allowance. In practice the transportation allowance is not always paid the farmers but is retained by the cooperative or at higher levels.

The cooperative, in turn, transports the grain to the OPAM warehouse or collection point at the cercle.[3] This is the first level at which OPAM is in control of the grain and no money changes hands here because the

[3]Note that the cooperative is not authorized to keep any stock to meet local needs but must send all grain collected to OPAM at the cercle level. Local requirements must be bought from OPAM at the cercle and shipped back to the arrondissement at the cooperative's expense--for which they are allowed a marketing margin of 1.5 MF/kg. Not surprisingly, the official retail sale price is not everywhere respected by the cooperative.

cooperative purchase price plus allowances have already advanced. Again, however, practice does not always follow theory. We were told that sometimes no money is received from OPAM by the cooperative until the grain is delivered.[4]

From OPAM at the cercle level the grain in excess of a stock authorized for cercle needs is forwarded to the Regional OPAM storage or transshipment warehouse.

Purchases Within Operations

Cereals purchases and marketing procedures within the areas encompassed by Operations are essentially the same as those outside. However, in these areas the Operation instead of the cooperative acts as the purchasing agent for OPAM.[5] Also, because farmers within Operations have been forwarded credit in kind, principal and interest payments are subtracted by the Operation from the farmer's sales proceeds.

In rice areas with publicly-financed land and/or where water resources have been developed, Operations also collect a land tax, which is for their use in maintaining irrigation infrastructure. In 1975/76 the tax, which does not cover all capital and maintenance costs, ranged from 100 kg/ha of good quality paddy at Operation Riz Mopti to 400 kg/ha in the Office du Niger.

Rice mills are operated by the Operations and by the Office du Niger. In general, only milled rice is delivered to OPAM. However, OPAM does accept some paddy when an export outlet can be found. In 1976 50,000 tons of paddy was available, but by late July no export contracts had been obtained.

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[4]Such caution is perhaps justified because this year, for example, OPAM advanced money sufficient for the purchase of 60.000 tons of millet. By late June, long after the official close of the buying campaign, only 42,000 tons were in OPAM's hands.

[5]As yet only those Operations whose primary focus is cereals have authority to perform cereals marketing. OACV has done it on an experimental basis only.

Sales from OPAM to Consumers

As outlined above, OPAM has no direct contact with producers of cereals; nor does it have any with consumers. OPAM sells cereals to consumers' cooperatives or to the groupements ruraux in rural areas. They, in turn, sell directly to consumers or, more often, to private retailers. The co-ops normally require purchasers to buy 50 to 100 kilogram sacks. Therefore, to obtain the small quantities that most consumers can afford, they are obliged to buy from private retailers in the marketplace.[6] Moreover, for coarse cereals consumers often prefer to buy in the market. There they can see what they are getting and can choose among qualities. OPAM makes no price differentials nor does it grade coarse grains according to type or quality.

Official Marketings

It is difficult to determine what volume of cereals OPAM has actually purchased in recent years and much more so to estimate the amount of cereals production that actually enters marketing channels. Excluding amounts that are sold or exchanged between villagers outside the market place, most observers consider that the volume of cereals "marketed" is in the range between 10 and 20 percent of the harvest. OPAM's official purchases have varied from as little as 15 percent of the amount marketed in 1968/69 to about 50 percent in years before and after the drought. When supply is short (and unofficial market prices high) OPAM is able to purchase a smaller percentage of the marketed volume than it can in average-to-good years.

Purchases of cereals (excluding rice) by OPAM are highly concentrated in the Zone Sud. This concentration results primarily because the Zone Sud, with only 26 percent of the country's population, produces 41 percent of total coarse cereals output. Production per capita in the Zone is between 300 and 350 kg per capita, as compared to average production for all of Mali of about 200 kg per capita. Thus in a normal year a surplus of about 35,000 tons is available for shipment to deficit zones.

[6] In Bamako market prices for small quantities of cereals average about 30 percent above the official prices for bulk sales at the consumers' cooperatives.

Farmers in other surplus or potentially surplus areas have less access to the official market for their surplus output. To them, the attractiveness of an inflexible official price in surplus years was demonstrated in 1974-75 and 1975-76. Many who avoided OPAM channels when free market prices were above the official price would have been happy to sell this past year when village-market and private-trader prices for millet fell to less than 20 MF/kg in some areas, the Séno Plain for example. This must have a discouraging effect on farmers who would increase production and invest in modernization if given price incentives.

The 1974/75 annual report of OACV states that from November to August, millet sold at prices of 20 to 25 MF at various places and times throughout the OACV Zone (Centre-Ouest).[7] At these low prices an important fraction of the marketable surplus did not find a buyer. But the organization of the buying campaign was also a factor. In a test of its ability to call forth the marketable surplus in its zone, the OACV purchased millet in the Kolokani sector between April 15 and May 25, 1975, after the OPAM buying campaign was completed. During this period, OACV was able to buy 651 tons of millet at the official price, 32 MF/kg.[8]

As these examples illustrate, at the present time OPAM does not have control of the coarse cereals market and is unable to carry out the nominal official price policy for these cereals, i.e. to establish an effective producer price floor (and ceiling) of 32 MF/kg.

Exacerbating the disincentive efforts of OPAM's failure to purchase all the cereals offered, or potentially offered, at the official price is their failure to enter the market as harvest begins, when many farmers must sell in order to clean out granaries for the current year's crop and to meet accumulated financial obligations -- and when free market prices are depressed. As explained earlier, in general OPAM's financing for

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[7] OACV, Compte Rendu de la Campagne Agricole, 1974-1975, p. 83.

[8] Ibid.

the buying campaign does not reach the local purchase points until mid-to-late January, up to three months after the harvest begins. Also, the financing is advanced in tranches as previous advances are accounted for, often causing the buying campaign to be interrupted until new funds arrive.

A related problem arises with respect to marketing "quotas" or targets established annually for each cercle, arrondissement and village in the areas where purchases of coarse cereals are authorized.[9] These targets based on projections of marketable surplus for the season made by local officials at mid-season, are fixed by the government and passed down through the adminstrative hierarchy. Because the targets are seldom modified once fixed, even if an unexpectedly bad harvest occurs, underestimation of the marketable surplus is the rule. The rigidity of the system obliges some villages or individual villagers to go into the free market and buy grain to meet their obligatory deliveries to OPAM. Others, with a marketable surplus above their quota, are also forced into the free market, as sellers. Unfortunately, the potential buyers and sellers are not necessarily in close proximity to one another and both may suffer financial losses as compared to what their net positions would have been if OPAM had the flexibility to adjust quotas and funds within the overall limits set by its marketing targets. The CEGOS study found that, of the villages they surveyed throughout the country, last year 18 percent had to buy on the free market to meet quotas and 43 percent wanted to sell more than OPAM would buy.[10]

Private traders play several important roles in cereals marketing. In normal years they enter the market during those periods when OPAM is not active, i.e., at harvest prior to OPAM's entry and during the gaps in OPAM funding. The traders, who generally buy at village markets

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[9]The term "quota" is used in BDPA's description of the official system for purchasing cereals. France, Ministère de la Cooperation, Mission de restructuration de l'office des produits agricoles du Mali (OPAM). Paris, BDPA, May 1975, pp. 19-21.

[10]IDET-CEGOS, Etude des Structures de Prix, III, p. 53.

(closer to the farms than the cooperatives go), thus provide an outlet for farmers who need to sell quickly or those who have more surplus production than they are authorized to sell officially. Because of the timing and location of their purchases, traders usually can buy at less than official prices. However, during times of general shortage they offer more than official prices and can effectively usurp the market from OPAM.

Private trader sales go to the export market through clandestine channels,[11] to the Bamako market, and, late in the marketing year or in times of general shortage, to village markets throughout the country. They are able to sell at prices above the official prices because they beat the official sellers, cooperatives, in timing and place of sale and because they will sell in small quantities and offer consumers an opportunity to select grain by quality.

Private traders of another sort, retailers in the major towns, buy from the consumers' cooperatives and sell in small lots, selected by quality.

Cotton

Cotton marketing in Mali is the responsibility of two state enterprises, the Compagnie Malienne pour le Développement des Textiles (CMDT) and the Société Malienne d'Importation et d'Exportation (SOMIEX).[12] CMDT is responsible for the cotton to the point where it has been ginned and baled for export. SOMIEX handles export marketing and transport.

Seed cotton is purchased by three-man buying teams of CMDT at designated village markets throughout the cotton zone. The buying-point villages are designated in advance of the buying season according

[11] Estimates are that 15 to 30 thousand tons of illegal exports occur year and such exports are of grain produced in border areas, areas where transport to the neighboring country(ies) is often easier than to domestic markets.

[12] This discussion is based on: CMDT, Rapport Annuel, Campagne Agricole 1974-75 en Zone Cotonniere, and on notes from interviews with CMDT and SOMIEX officials.

to the tonnage of cotton expected to be offered for sale from farms in the surrounding area. From 15 to 45 tons of seed cotton are required for a village to be designated a buying point, with areas having difficult access to alternate markets qualifying at the lower limit.

In 1974-75 twenty-nine buying teams made purchases at 1,825 buying points, collecting an average 33 tons of seed cotton at each. Two or more market days at different times were held at some markets, resulting in an average of 1.5 market days per buying point.

Farmers selling at the buying point have their cotton weighed and graded and are paid on the spot, 75 MF/kg for 1st quality cotton, 50 MF/kg for 2nd and 3rd quality. About 95 percent of the cotton sold is graded 1st quality. From the total sales value are subtracted principal and interest due on equipment and the total cost of other inputs--fertilizer, insecticides--which have been advanced on credit by SCAER with CMDT as its agent. Payment for seed, advanced by CMDT, is also collected.

Barème for Cotton Lint (1975-76)

	(MF per ton)
Purchase of seed cotton	74,000
Primary marketing cost	1,436
Transport to ginnery	7,327
Municipal tax	200
Extension services	11,893
Tax for SCAER	10,733
Fee for CFDT	2,500
Insurance for seed cotton	359
Total cost of seed cotton	108,448
Total cost of lint equivalent @37.607%	288,426
Ginning	39,037
Lint insurance	2,099
Financial charges	17,878
CMDT commission	17,581
Tax for ORSP	10,000
Total cost of lint ex-ginnery	375,021

The seed cotton collected is transported to one of the eight CMDT gins (total capacity, 85,000 tons) in the cotton zone by trucks and trailers owned by CMDT. After ginning the cotton is sold to SOMIEX.

SOMIEX arranges for export contracts through an international cotton broker and moves the cotton to the port (Abidjan) using private trucks or trucks of the Compagnie Malienne.

Payment to CMDT by SOMIEX is made only after the cotton is shipped. In principle payment is made 90 days after billing, which occurs one month after the cotton is transferred to SOMIEX. We were told that at times there is some delay beyond this limit.

Even when payment is received in the allotted time, the method of payment causes financial problems for CMDT. which has borne the cost of purchase, transportation and ginning. The problem is particularly acute because SOMIEX is very slow in moving the cotton, as a result of transportation difficulties (a shortage of trucks) and a desire to wait for the best possible export price.

The slowness with which SOMIEX exports cotton lint creates another problem even more damaging than the financial one. At Koutiala we saw large stacks of baled cotton in the gin yard two to three weeks into the rainy season in mid-June. We were told that CMDT had 12,000 tons of ginned cotton on hand but storage for only 6,000 tons.[13] They also had 15,000 tons of cottonseed exposed outside.

As a method to alleviate the problem of the export bottleneck, or at least to place the burden directly on CMDT, the World Bank has proposed that CMDT be given the authority to export cotton lint directly. If the proposal were implemented, SOMIEX would handle lint exports only under barter agreements, currently about 25 percent of the total. Cottonseed export sales would be left to private interests, who as a temporary measure were allowed to compete with SOMIEX in 1976. The cottonseed which is exported, approximately 24,000 tons in 1975, may actually be selling at a loss because Malian cottonseed is not high enough in oil content to be competitive on the world market.

Current procedures for domestic cotton sales appear to work well. The CMDT sells directly to the two state textile companies, COMATEX and

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[13]We attempted to explore this question at SOMIEX but were told that no such problem exists. We had to admit that we had not looked in the warehouse at Koutiala.

ITEMA, and to private artisans. Sales to these outlets in 1975 were 2,600, 1,076 and 400 tons, respectively. Exports by SOMIEX were 18,906 tons.

Another problem with potentially large effects on cotton marketing is ginning capacity, which is already pushed beyond its limit. At Sikasso this year, purchases of seed cotton beyond the available ginning capacity were made with full knowledge that it could not all be ginned before the onset of the rainy season. About 1,000 tons of seed cotton had already been spoiled by rains at Sikasso at the time of our visit. Local officials did not want to break the impetus of increasing cotton production, which would inevitably result if some cotton offered for sale were not bought. Obviously such a policy can only work in the short run.

At Sikasso a shortage of trucks, even after some in private ownership were commandeered, hampered the orderly movement of seed cotton to the gin. Storage for unginned cotton at this and other gins is one day's supply, which requires regular cotton flows throughout the ginning season if losses due to outdoor storage are not to occur. The CMDT manager at Koutiala estimates that storage capacity for two-to-three days supply is needed at a minimum.

Fortunately, about 5,000 tons of new ginning capacity, an old gin at Koutiala which is being repaired, will be on line by the coming season and more is planned, as is additional seed cotton storage. The problem of trucks--or of road improvements so the available trucks can make more trips per day--is yet to be addressed.

Peanuts

One of the reaons for OACV's success in peanut marketing is the effectiveness of its organization. The decline in marketing levels in the mid-sixties prior to the creation of the Operation had been due in part to price stagnation at a low level and in part to the fact that the government had abolished free trade in peanuts. Nicholas Hopkins described the way the old system had worked:

> African merchants, who knew the country and had personal relations with the peasants whose peanuts they were buying, would roam the countryside looking for peanuts and would return to places where they customarily bought them. They would often offer consumer goods at the same time. They usually worked on commission for Lebanese merchants, who advanced them money and goods. The Lebanese would then sell the peanuts to one of the European trading companies. Slight fluctuations in peanut prices gave the middlemen the opportunity to outbid one another, and thus gave the peasant the chance to feel that he exercised some control over the situation.[14]

In at least two important respects the OACV organization of marketing has restored elements that were valued by the farmers. Most important is the fact that OACV's buying teams, of which there were 76 in 1974-75, scour the countryside as the merchants once did and make it relatively easy for the farmer to sell his peanuts. The second element is the existence of committees at both cercle and arrondissement levels (comités arachidiers) on which farmers are represented. These committees give farmers some say in deciding where buying points will be established and the dates on which they will function. In 1974-75 there were in fact 408 buying points in the OACV zone. OACV also states that it has a policy of "encouraging literate farmers to participate in the marketing operation whenever possible."[15] Village representatives observe the weighing of peanuts and the payment of farmers. They may appeal to the village chief and an OACV agent if they believe a transaction has been mishandled.

As long as a group of farmers, a village or cluster of villages can put together 80 sacks of 50 kg each, the Operation will send a truck to bring the peanuts to the buying points at no cost to the farmer. OACV is justifiably proud of this method of collection which clearly distinguishes its system from that used for cereals. In fact, the official schedule of

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[14] Nicholas S. Hopkins: Popular Government in an African Town: Kita, Mali. Chicago, the University of Chicago Press, 1972. pp. 40-41.

[15] OACV, Compte Rendu, p. 67.

charges allows OACV to recover 5,567 MF per ton for collection when it sells peanuts to the processing and exporting firms SEPOM and SOMIEX. Since similar charges are not allowable in the present system for purchasing cereals, OACV would take a loss on collections if it bought cereals as well as peanuts. This is the reason why the Operation is reluctant to get into the cereals-buying business, even though test runs have proved it could be very effective, unless and until the schedule of charges is changed.

Barème for Peanuts 1974-75

(MF per ton)

Producer price	40,000
Costs of collection	5,567
Bagging and handling	429
Market and purchasing costs	990
OACV extension costs	10,000
SCAER levy	8,936
Cost of seed subsidy	2,260
1% of loss of weight	400
IBRD grant for road maintenance	3,120
Price paid by SOMIEX and SEPOM	71,902

Source: OACV, Compte Rendu, p. 68.

The Operation nonetheless has real problems in carrying out its peanut marketing campaign, and they are getting worse as tonnage increases. One is getting enough trucks to collect peanuts at the village level and then to transport them from the buying points to the spots ("seccos") where they are delivered to SOMIEX and SEPOM. OACV has a fleet of some 50 trucks of its own and hires about 120 more from private truckers. Difficulties arise from the fact that the private truckers (a) are relatively well equipped in heavy trucks but have few smaller trucks suitable for rural roads; and (b) are dissatisfied with the allowable rate per kilometric ton. The latter remains at 65 MF on rural roads (80 in the First Region) and 40 MF on "national" roads. OACV estimates unofficially that given the condition of most roads and the cost of fuel,[16] the rate per kilometric ton should be as high as 110 MF to make peanut marketing

[16] 165 MF/liter for regular gasoline, the equivalent of $1.30/gallon.

worthwhile for private truckers. What happened in 1975-76 was that most truckers withdrew after making between two and ten trips.

In 1975-76 there was also a severe shortage of sacks, and in certain sectors supplies of fuel were exhausted; so that even when truckers were available and willing to haul peanuts, they were on occasion stymied by other shortages. Nor does the Operation escape the usual financing problems. SOMIEX and SEPOM are supposed to make funds available in advance for the marketing campaign, which usually begins officially on December 1st. (The Operation does a small amount of buying with its own funds in October and November to accommodate farmers who need cash.) In 1974-75, however, the campaign was delayed a month by lack of funds and sacks, and in 1975-76 it dragged on into May. It is not surprising that OACV has sought the right to borrow directly from the Development Bank and to supply its own sacks.

PART II. DISCUSSION OF ISSUES

A. SELF-SUFFICIENCY IN CEREALS

Mali has set a goal of self-sufficiency in cereals by 1978-79. It hopes to achieve this through increased rice production and through more emphasis on cereals production in the peanut and cotton zones.

In the two years since the end of the drought, several circumstances have combined to create the somewhat unexpected situation where cereals are already in surplus. In fact, Mali finds itself once again in a position to export. First, it is probable that when farmers decided how much land to plant in 1974 and again in 1975, they hedged heavily against the possibility of another drought year. Second, substantial deliveries of drought-relief grain arrived after the plentiful harvest of 1974-75. Third, the increase in cereals prices in June 1974 provided an incentive for some market-oriented farmers to cultivate and market more cereals than they would have otherwise.

None of these special conditions is likely to persist much longer. At the farm level, it is reasonable to assume that stocks have by now been rebuilt to traditional levels and farmers no longer have cause to overplant. By June 1976 central stocks of drought-relief grain were no longer large, according to OPAM, and those remaining were being distributed by the Ministry of Defense. Finally, the incentive effect of higher prices has now been dissipated both by very low prices on the free market and by OPAM's inability to intervene more effectively at the official price.

Even with a return to more normal circumstances, we conclude that Mali is basically in a position of self-sufficiency today. The rapidity with which the country rebounded from the effects of a severe drought provides impressive evidence of the resiliency of its productive capacity. Cereals, it would appear, are being produced and stored in quantities that are still unmeasurable and in response to dictates that are still imperfectly understood; but the capacity to produce seems to be in place.

If it created a security stock, Mali should be able to handle future periods of poor rainfall that do not last more than two years. In isolated years of inadequate rainfall the real problem is apt to be one of distributing cereals from surplus to deficit zones rather than one of production. Accordingly, the inadequacy of the present system to market and distribute cereals should be the cause of most concern. In poor years the system cannot coax into the market sufficient amounts to meet the needs of deficit zones. In good years it cannot handle the volumes that farmers want to sell. Recognition of these deficiencies has led to valuable studies of the situation by BDPA and IDET-CEGOS and to an impending reorganization of the cereals marketing organization, OPAM.[1]

Malian self-sufficiency or lack thereof is of course only one element in the question as it applies to the Sahel countries as a group. The World Bank and other observers consider that Mauritania and Niger are the two Sahelian countries that in the long run will have the most difficulty. As populations increase and land becomes a scarcer resource, these two Sahelian nations least endowed with rainfall will probably have to rely increasingly on their neighbors for cereals. Mali happens to be situated between them.

In the two post-drought years, Mali's ability to respond to such opportunities has been limited by its capacity to export more than by its ability to produce. In 1976 OPAM obtained contracts to sell 20,844 T of millet to Senegal and The Gambia and 15,000 T to Niger. The problem was getting it there. The organization's original aim for shipments to the coast was 1,250 T per week by rail, but by late June 1976, a total of only 1,253 T had travelled over the Dakar-Niger railway. OPAM had by then asked for the use of Senegalese freight cars and had decided it could

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[1] BDPA: Mission de restructuration de l'office des produits agricoles du Mali, May 1975; and IDET-CEGOS: Etude des Structures de Prix et des Mecanismes de la Commercialisation des Mils et Sorghos, May 1976. In June 1976 the Malian state-owned management-consultant firm, IPGP, was preparing its recommendations on the reorganization of OPAM.

handle no further orders for 1976. Millet exports to Niger, on the other hand, were progressing smoothly because Nigerien trucks had come to Gao and even as far as Mopti to take delivery.

Unlike Malian millet, Malian rice has not recently been competitive in neighboring countries in price and quality. Since the drought the country has not been able to meet the low prices at which Asian rice with a high percentage of brokens (a quality that appeals to Senegalese tastes) is delivered to Dakar or Nouakchott. In 1976 Senegal took an option on 20,000 T of rice from Mali but decided not to exercise it. Malian rice should sell for no less than 128,000 MF per ton FOB the border post at Kidira, according to OPAM, but Senegal was offering only 70,000 MF/T. By the same token, Mauritania showed interest in Malian rice in 1976 but was eventually able to import Asian rice at the equivalent of 75,000 MF/T CIF Nouakchott. The price disparity indicates the difficulty that Mali has in competing on coastal markets.

The West African Rice Development Association (WARDA) has contracted with the Stanford Food Research Institute to study the economics of rice production and trade in West Africa. The data may show that traditional exports of "white brokens" to Senegal can be resumed, at least in the eastern part of the country, but this market is likely to be relatively small. One comes to the conclusion that under present circumstances it will be as a supplier more of millet than of rice that Mali should be able to help fill the deficits of less-well-endowed neighbors in the Sahel.

Reform of the Marketing-Distribution System

The drought and its aftermath clearly showed that the country needs more flexible ways of handling cereals in order to cope with both good years and bad. What is it that needs to be done?

There has been some desire by the government to maintain a buffer stock in order to lessen price fluctuations from year to year. The creation of sufficient storage capacity in the proper locations would be extremely costly if OPAM were to control enough of the market to dampen fluctuations. It now handles no more than one-half of the total volume

of cereals traded and in bad years much less.

While the creation of a buffer stock to reduce price fluctuation would be costly and difficult, the creation of a security stock for use in the early months of a new drought is almost certainly advisable. The question now is not whether Mali should create a security stock but what it should contain and how large it should be.

John Caldwell has written that during the recent drought rural populations in the Sahelian countries were able to use a rugged means of adaptation: they consumed less (through organized fasting) and at the same time increased their "use of types of food identified and used as staples for tens of thousands of years before the institution of grain culture perhaps two millenia ago...".[2] By such induced changes in consumption habits as well as by drawing down farm grain stores, a one-year cereals deficit of up to 100,000 T can be absorbed in rural areas of Mali, according to the IDET-CEGOS study.[3] Urban consumers are not so flexible, however, and it is primarily for them and for the chronically deficit areas that a security stock of adequate size is needed.

What level would be the prudent minimum? It depends on the extent to which Mali is willing to rely in advance on food aid from international donors. The alternative of creating a larger security stock is an expensive one. IDEC-CEGOS concludes that if Mali is willing to rely on external donors for 25 percent of its import needs in case of two successive years of drought, a security stock of 60,000 T would be close to the optimum.[4] In early 1976, the Malian Government in fact requested the European Development Fund (FED) to finance the creation of a security stock of precisely this size.[5]

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[2]Villagers resorted to wild plants and edible leaves as well as to producing more sweet potatoes, yams, manioc, beans, etc. John C. Caldwell, The Sahelian Drought and its Demographic Implications, OLC, Washington, Dec. 1975, pp. 48-49.

[3]IDET-CEGOS, op. cit., p. 71

[4]Ibid., pp. 73-76. The study's assumptions are: (a) that in a first drought year the amount of cereals marketed will fall by 50% from 120,000 T to 60,000 T; (b) that in a second year no cereals will be marketed at all; and therefore (c) that the country will require 60,000 T the first year and 120,000 T in the second and succeeding years of a drought, to be supplied from the security stock and from both purchased and donated imports. In our opinion assumption (b) is too strong.

[5]Mali, Ministère du Développement Rural, Stock de Securité, Feb. 1976.

A 60,000-ton security stock would be less expensive the higher the proportion of coarse cereals that it contains. The Government proposal, however, is for a security stock of rice alone. One estimate is that it will cost $20.2 million. (The alternative of importing 60,000 T in a first drought year is even more expensive -- $25.3 million based on OPAM's actual import costs in 1973-74 -- and delays would undoubtedly be encountered.) If for no other reason than to reduce cost, it would be advisable to constitute the stock with coarse cereals as well as rice. No matter what its composition, the problems of potential loss and spoilage as the stock ages and is periodically replaced reveal that a security stock is no panacea.

We are inclined to agree with other outside observers that 60,000 T may be excessive at current consumption levels. We believe it quite possible that the huge imports during the recent drought were only partly a function of real shortage. They seem also to have been a function of (a) a producer price policy that did not encourage farmers to release their own stocks, a matter we discuss in the next section and (b) the availability of food aid on concessionary terms.

The supply of concessionary food can have several unfortunate effects:

(1) It provides an easier means of assuring urban supply than the alternative of developing production and marketing programs.

(2) It tends to depress the price of cereals and thus weaken price signals to producers.

(3) It weakens the resolve of governments to increase domestic production and marketings and diverts resources to revenue-producing cash-crop production.[6]

Supplying Deficit Zones

Another objective in any effort to improve the marketing and distribution system would be to create the capacity to provide sufficient grain to the deficit zones in both good years and bad. The amounts will

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[6]These points were suggested by W.H.M. Morris. For similar arguments see also W. David Hopper, "The Development of Agriculture in Developing Countries," Scientific American, Sept. 1976, p. 203.

obviously vary. With the exception of the city of Bamako, the deficit areas in question consist principally of towns in the Sahelian zones of the First and Sixth Regions: Kayes, Nioro du Sahel, Nara, Niafounké, and Bourem.[7] Bamako is in a position to be supplied almost entirely by private traders who can undercut official prices. Their activity is not officially sanctioned but does serve the government's aim of keeping prices of essential foodstuffs down and at the same time takes pressure off the official supply network. On the other hand, OPAM is thereby prevented from balancing the profitability of the relatively low-cost Bamako trade against the high cost of delivery to deficit zones.

The objective of a more flexible system would be to supply the northern tier of towns and their hinterlands to a greater or lesser extent, depending on the adequacy of the most recent harvest. Most of the responsibility for this falls to the government. To the degree that the northern hinterland can come closer to self-sufficiency, the requirements on the official distribution system will be lowered. The above-average years of rainfall in the 1950s and early 1960s having encouraged a movement of population northward to increasingly marginal Sahelian lands, the drought in turn made it clear just how fragile was their ecology. Greater self-sufficiency will be difficult to achieve but can be promoted in part by providing relatively small amounts of development aid for the improvement of flood-recession agriculture in this zone. The objective should simply be one of helping the existing population to grow more food for itself.

For the country as a whole, the question then becomes: how can an adequate amount of cereals be enticed onto the market without attracting too much? Excess cereals not needed in the deficit zones nor for security stocks nor for export should be left on the farm. (Farm storage is less costly and less risky than central storage at the arrondissement or cercle level.) What changes in the present system might accomplish this? Since

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[7] The cercles of which these towns are the capitals were listed in the BDPA report on OPAM as the ones with theoretical deficits of 10,000 T or more annually in the 1970-72 period. Mopti Cercle also appeared to have a large deficit, which the report found puzzling. Op. cit., pp. 8-13.

it is possible that the free market price for cereals reflects more accurately than any other measure the sufficiency or inadequacy of the most recent harvest, nationwide, the first requirement is an official producers' price that follows the free-market price more closely. Among other things it would permit recovery of storage costs. One method would be for the government to allow its official price to fluctuate, perhaps within a set range, along with the free market price. This kind of recommendation, however, presents philosophical problems for the Malian Government that may simply be insurmountable at the present time. Another method that has been suggested would be for the Government to announce a fixed amount that it would purchase at the official price. On reaching the limit, the government would continue to buy but at a price approaching that of the free market.

In either case, the introduction of flexibility would present clear advantages. In better-than-average years, for example, a lower official price should bring less grain into the official market. This would mean that:

(1) There might be fewer losses from spoilage;

(2) Government funds would not be spent unnecessarily on marketing and central storage operations;

(3) Mali's limited purchasing, transportation and storage infrastructure would be subject to less strain; and

(4) Efforts could be concentrated on getting cereals from surplus to deficit areas rather than on coping with the excess.

In poorer-than-average years prices would be higher but would help to entice onto the market quantities needed in deficit areas.

Aside from price, what other elements of flexibility might be introduced? The way in which cereals are marketed in an obvious place for change. In the past, official cereals marketing has suffered from several defects. Among these are: (a) the lateness of OPAM's arrival in the market[8] and its periodic withdrawals; (b) OPAM's extreme sluggishness, even

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[8]The delay is caused by the fact that the Development Bank does not release funds to OPAM until December, three months after farmers want to start selling to raise cash or clean out granaires before the harvest. See IDET-CEGOS, II, p. 41.

inability, to react to changes in the supply situation; (c) the uneven performance of the cooperative organizations in making local purchases; and (d) the inadequate and often non-existent reimbursement given to the village cooperative (groupement rural) for transporting cereals to the arrondissement.

This year (1976-77), the Government is authorizing OPAM to take possession at the arrondissement level rather than at the cercle. This may make the system somewhat more efficient but it still cannot compare, for example, with peanut marketing arrangements, under which official buying teams go down to the village level whenever farmers can bring together a truck-load of 80 sacks. Nor does it solve the other problems mentioned above. The fact is that some Operations are capable of doing a good job of buying cereals at the same time that they buy their cash crops. The marketing operations are not only well organized, effectively funded and possess (or can get on contract) the vehicles required for their cash crops; they also tend to have the confidence of farmers. There may be definite advantages to having the farmer deal with a single buying agent for both cash crops and surplus cereals.

The Operations, however, do not want to get involved for two reasons. First, the "barème" of charges allowable in the cereals marketing process does not allow them to recover fully their transportation costs. (OPAM faces the same problem, of course, and whether it continues to market cereals or someone else does, the system clearly needs to be changed so that transportation costs are fully covered.) Second, there is a shortage of medium-sized trucks, both private and government-owned, that are available for buying cereals at the village and arrondissement levels. Not only is the fleet limited; there is also a disincentive to private truckers in the fact that the allowable charge per kilometer-ton is considered to be much too low.

If some of the Operations do not get into cereals marketing, who will? Some observers think that the marketing of millet and sorghum, if not of rice, should be left almost entirely to private traders. It should be possible to find a role for the private traders which would allow them to

serve the government's interests while they serve their own. Given a smaller role, OPAM would enter the market only from time to time, to build up security stocks and to provide some "competition". But such a major reversal of government attitude is unlikely to occur in the near future.

Let us suggest, however, that in addition to adopting fluctuating prices, the government leave entire zones to private traders, reserving others to itself where there is a clear advantage in doing so. One such scheme would have the Operations based on rice, millet and sorghum buy for the account of OPAM, being fully compensated for costs incurred. In the peanut zone, where OACV has begun to put emphasis on maize production, the Operation's buying teams might buy maize at the same time and places they buy peanuts. This would help OACV recover loans for equipment and fertilizer and might give the farmers, many of whom prefer to sell their maize and buy millet with the proceeds, an easier time marketing the crop.

The purchase of rice from the rice Operations (including the Riz Sikasso division of Mali Sud) and from the Office du Niger would permit the government to build up the security stocks that it wants. The problem here is not one of production but one of processing. If FED agrees to finance the recent request for a 30,000-ton-capacity rice mill and for 60,000 tons of storage capacity, this would remove part of the bottleneck in milling and much of it in storage.

The question still remains whether government purchase of rice, millet, sorghum, and corn in the zones of emphasis for these crops will be sufficient to fill the deficits of the northern tier. No definitive answer can be given at this point, in large part because so little is known about the real requirements of the deficit zones. As the IDET-CEGOS study points out, needs are calculated now on the basis of demographic data alone. The situation is complicated further, at least in the Sixth Region, by the remainder of a supply of red sorghum (now deteriorating in quality) that was provided by outside donors during the drought. It is in much less demand than white millet, which is brought in and sold at high prices (60 to 80 MF/kg) by private traders.[9]

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[9] IDET-CEGOS, op. cit., II, pp. 51-52.

We conclude that it is a matter of considerable importance for the government to determine what the actual needs of the deficit zones may be and to study ways in which cereals from the surplus zones can be efficiently shipped to them, including maximum utilization of the Niger River during its navigable months. The IDET-CEGOS study makes several pertinent recommendations that could help the government in its search for solutions to the problem.

B. AGRICULTURAL PRICE POLICY

In Mali, as elsewhere, agricultural price policy is seen as one means contributing to the achievement of numerous (though often conflicting) objectives. The CNPER final report specifies that in conformity with the goals of the Plan price policy must:[1]

(1) Encourage farmers to adopt animal traction equipment. Basic equipment is a prerequisite to increased agricultural productivity and subsequent technical development.

(2) Focus on the great mass of farmers, those who have neither a large labor force, nor initial capital, nor income from other sources.

(3) Give the government the ability to control markets in order that it may carry out its responsibility for income policy, for financing public services, and for providing food to towns and deficit rural areas.

These objectives express a government intention to maintain product-input price differentials in agriculture sufficient to induce traditional farmers to produce a marketable surplus, to save, and to invest in agricultural equipment. Moreover, together with the government's often-expressed desire to maintain consumer price stability in basic foodstuffs and equity among regions, the third objective implies that official price policy should seek to hold down consumer prices in urban areas and in food-grain-deficit rural zones. It also implies that producer prices, particularly of export crops, should be set in such a manner as to generate government revenues through marketing or export taxes.

Agricultural Prices

Tables 27 and 28 present data which illustrate the agricultural price policies implemented in Mali in recent years.

As shown by Table 27, official agricultural product prices have increased steadily since the mid-1960's. Between 1968 and 1974, millet-sorghum and rice prices doubled, peanut prices increased 67 percent and cotton prices 87.5 percent. Official input prices were also raised periodically. Equipment prices, raised somewhat in 1970, remained constant through 1974, but the impact of world oil price changes was felt in

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[1] CNPER, Programme du Secteur, I, p. 23.

Table 27. Official Producer Prices for Selected Agricultural Products and Inputs

Item	Year[1] 1965/66	66/67	67/68	68/69	69/70	70/71	71/72	72/73	73/74	74/75	75/76	76/77
Product Prices (MF/kg)												
Millet-sorghum	11	15	16	16	18	18	18	20	20	32	32	32
Rice (paddy)	12.5	16	18	18	25	25	25	25	25	40	40	40
Maize	13	16	17	17	17	20	20	20	20	32	32	32
Peanuts (in shell)	13	16	24	24	30	30	30	30	30	40	40	40
Seed Cotton[2]	34	34	40	40	45	50	50	50	50	75	75	75
Equipment Prices (1000 MF/unit)												
Plow (Charrue TM)			11.9	18.4	18.4	23.6	23.6	23.6	23.6	23.6	31.9	45.6
Harrow			9.8	13.4	13.4	17.3	17.3	17.3	17.3	17.3	23.4	--
Toolbar with attachments (Multiculteur)			15.3	20	20	30	30	30	30	30	40.5	80
Seeder			14.2	18.5	18.5	18.5	18.5	18.5	18.5	18.5	25	55.5
Cart (1000 kg)			18.9	25.6	25.6	32.8	32.8	32.8	32.8	32.8	44.3	60.9
Trained pair of oxen[3]			35	35	45	55	60	60	70	75	80	150
Fertilizer Prices (MF/kg)												
Cotton Mixture							53	53	53	55	75	110
Urea							60	63	63	63	85	92
Ammonium Sulphate				60	60	85	85	85	85	--	55	82
Ammonium Phosphate							40	40	40	40	55	95
Superphosphate (single)			40	40	40	49	54	54	54	54	61	60

[1]Production-marketing year beginning in the year indicated. [2]First quality. [3]Market price.

SOURCES: CEEMAT/SEAE, Etude de l'Evolution des Facteurs de Production, pp. 22, 52; Mali, IER, "Coûts Moyens de Production," June 1976, p. 34; France, Dossier d'Information Economique: Mali 1972-73, Annexe 4; World Bank; OACV, Compte Rendu de la Campagne Agricole, 1974-1975, p. 104 (shows equipment price increase in 1971-72 rather than 1970-71); Unpublished data.

1975 when prices of plows, toolbars with attachments (multiculteurs) and ox-carts increased by 73 percent, 50 percent, and 75 percent, respectively. Lesser increases in prices of fertilizers and other annual inputs occurred in the same year.

New and substantial price rises for agricultural implements and chemical inputs in effect for the 1976-77 agricultural season have changed this picture. Inputs now cost up to 200 percent more than they did in 1970. Since these new increases were not matched by product price rises, the historical relationships between official product and input prices have been significantly altered. In fact, with regard to cereals, it can be said that these relationships -- to the extent that purchased inputs are used on cereals -- had already been changed by the low free-market price that has prevailed since the end of the drought.

From an international point of view, the data in Table 28, show that producer prices in Mali are clearly lower than prices in other West African countries.

Table 28. Price comparisons for major crops in Mali, 1976.

Crop	Producer Prices (MF/kg)[a]		Consumer Prices[a] in Mali (MF/kg)	Import Prices (MF/kg)
	Mali	Neighbors		
Millet, Sorghum, Maize	32	36-37	51.3	40
Rice (paddy)	40	70-130	111.5[d]	55-70
Peanuts (in shell)	40	83	115-185[e]	54
Cotton	75	80-140	--	164
Kenaf	100	250	--	--

[a]Official prices.

[b]Import prices are for processed products (e.g. cotton lint, milled rice) CIF the Malian frontier, converted to a raw product basis (1975 prices).

[c]In general the high prices shown are for Ivory Coast or Senegal; the low prices are for Upper Volta.

[d]Milled rice.

[e]Free market price for shelled and roasted peanuts.

SOURCES: BCEAO, Notes d'Information et Statistiques, January 1976.
IER, Couts Moyens de Production, Annexes.
CNPER, Programme du Secteur, I, pp. 39-46.

Yet, except for cotton, they are not particularly low vis-a-vis world market prices when average costs of transport to the frontier (6-20 MF/kg)[2] are added to the base prices. The producer price for cotton is, however, less than one-half the unginned cotton world market price FOB the Malian frontier. In 1974 CNPER calculated that each kilogram of cotton produced in Mali earned 194 MF for the government and its agencies and each kilo of peanuts earned 29 MF. These figures are exclusive of extension agency taxes of 10 and 4 MF/kg, respectively, which were also collected and were retained by CMDT for cotton and OACV for peanuts.[3] (The extension agency taxes were later raised.)

The Effects of Price Policy

The function, and effectiveness, of agricultural price policy can be evaluated from several perspectives. Perhaps of first importance in the context of the 1974-1978 Plan is an evaluation of the impact of price policies on self-sufficiency in food grain production.

As was noted in Section II (A), the need to achieve self-sufficiency may now be a moot point. However, whether price policies can be credited with the rapid recovery from the large food grain deficits of 1972-73 and 1973-74 is not clear. The sharp increase (60 percent) in official prices of cereals during the 1974-75 season came after planting, a fact that certainly lessened its impact on production in that season. Nevertheless, production of millet, sorghum and maize increased by about one-third over each of the two previous years to 950,000 tons. Paddy production increased to 215,000 tons in 1974-75, up from 90,000 tons the previous year and 100,000 tons in 1972-73. Good rainfall, a normal Niger flood, and the farmer's attempts to reconstitute reserves after the drought are probably the major explanatory factors.

Further increases in output (to 975,000 tons of coarse grains and 260,000 tons of paddy) in 1975-76, an average rainfall year, probably reflect a response to the 1974 price increases. Price increases of

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[2] Ibid, p. 40.

[3] Ibid, p. 45, and CNPER Secretariat, "La Politique des Prix et les Coûts des Produits Agricoles," Dossier Principal. March 1974, p. 2.

35-40 percent for agricultural inputs, promulgated in January 1975 and hence effective for the 1975-76 season, may have somewhat dampened the incentive effects of the product price increase. However, only the farmers actually making cash expenditures for inputs were affected in a practical sense by the input price increases. Probable longer run consequences will be reductions in the rates of adoption and use of purchased inputs.

Unless soon matched by commensurately higher product prices, the input price increases announced for the 1976-77 season will move basic equipment purchase costs beyond the financial reach of a large proportion of the farmers not already equipped.

Even with liberalized credit terms, a farmer seeking minimum mechanization must buy a pair of oxen costing from 120,000 to 150,000 MF and make a down payment of from 10,000 to 20,000 MF for a simple plow (charrue TM). In 1974, the oxen pair cost 50,000 to 60,000 MF and the down payment for a plow was about 7,000 MF.

In the OACV zone a family of 10 farming 5.2 hectares with hand labor -- 50 percent in peanuts, 50 percent in cereals -- can expect to earn an annual net cash income of about 60,000 MF, all from peanut sales, if they use improved seed and fungicides.[4] Thus, at the old equipment and, particularly, oxen prices, prior saving equal to one year's gross cash income was required to make the first move toward modern animal-traction farming. With current prices, saving equal to two years' gross cash income is necessary.

Financing equipment purchases is difficult even for farmers producing cotton, the crop characterized as the engine for financing farm modernization in southern Mali. The cotton plot for a typical farm family using traditional methods is limited to about one-half hectare by the crop's relatively high labor requirements, roughly twice that of millet and sorghum, and by the need to produce adequate food grains for family consumption. Net cash income on such farms, all from cotton sales, ranges up to 35,000 MF, if a yield of one ton per hectare is achieved, which is slightly above the national average.

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[4] OACV, Compte Rendu de la Campagne Agricole, 1975-1975, pp. 51-53.

For traditional farmers producing only coarse cereals and cowpeas, e.g. those on the Sēno Plain, the initial capital required to modernize is clearly unattainable unless outside income sources such as livestock production or remittances from off-farm work are available and tapped for this purpose. Livestock income is available only to the less than 50 percent of Mali's farmers who own livestock.[5] Nor are time and opportunity for off-farm work available to all families. It is noteworthy that with a wage of 500 MF per day -- the urban legal minimum wage is 70 MF per hour-- 250 to 300 days of work would be required to obtain enough gross income to make the initial payments for oxen and plow.

Table 29 illustrates from another perspective the increasing difficulty of financing agricultural equipment. In 1973 the cost of an oxen-drawn plow (charrue TM) ranged from 0.48 tons of seed cotton to 1.18 tons of millet, sorghum or maize, each valued at official producer prices. In the same year, the cost of a multiculteur ranged from 0.60 tons of cotton to 1.50 tons of coarse cereals. Because of the product price increases in 1974, the relative costs of equipment fell by up to 30 percent, but the equipment price increases in 1975 and again in 1976 reversed this trend and pushed the unit product cost of equipment to the highest level seen in the past 10 years. It will now take two and one-half tons of rough cereals -- 5 hectares of production at average yields -- or about one ton of cotton to purchase a multiculteur.

Table 29. Unit Product Cost of Agricultural Implements, 1973-1976. (in tons of product)

Product	Plow (Charrue TM)				Multiculteur			
	73	74	75	76	73	74	75	76
Millet, sorghum, maize	1.18	0.74	1.00	1.42	1.50	0.94	0.94	2.50
Rice (paddy)	0.94	0.59	0.80	1.14	1.20	0.75	0.75	2.00
Unshelled peanuts	0.79	0.59	0.80	1.14	1.00	0.75	0.75	2.00
Seed Cotton	0.48	0.31	0.42	0.61	0.60	0.40	0.40	1.07

SOURCE: Table 27.

[5] See Rapport de l'Enquête Agricole, 1972-1973, p. 25.

The point of this discussion is that current product price levels are too low to encourage, or even allow, rapid expansion of animal traction use in Mali. Only farmers already equipped have sufficient production capability to earn from agriculture the cash income levels necessary for further investment. With respect to the problem of expanding animal traction, it should be recognized that increasing product prices will help but will not quickly solve the problem because of the low hectarage, yields and marketable surplus potential of farms using traditional hand labor methods.

However, for those farmers who now have or are able to finance animal traction equipment, the possibilities for expanding production per hectare and per man-day are such that current product-input price ratios do encourage increased use of purchased inputs and increased production. For example, millet produced under traditional hand labor conditions on the Séno Plain might yield 0.4 ton per hectare. Net returns to land, labor (95 man-days), and management would be 12,800 MF per hectare, 135 MF per man-day. Upon adoption of animal traction and use of some other improved practices, e.g. fungicides and thorough weeding, a yield of 0.7 tons and net returns of 14,900 MF per hectare and 270 MF per man-day could be expected. Addition of improved seed and fertilizer and better management could increase yields to 1.4 tons, net returns per hectare to 23,200 MF, and net returns per man-day to 375 MF. (See Table 30.) Even larger improvements in yields and net returns could be expected in higher rainfall areas such as the Mali-Sud zone.

Results of a 1976 sample survey of farmers in 28 villages located in Bamako, Ségou, Sikasso and Mopti Regions indicate that they would react to price incentives (increases) by increasing production, some of which they would make available for sale. Similar responses were obtained in unstructured farmer interviews that we conducted in several regions. Unfortunately, planting, input use, and production data are too poor at the present time and too subject to other factors to allow quantitative verification of these farmer responses.

Table 30. Estimated Yields, Labor Requirements, Costs and Returns for Important Crops in Mali, 1976*

Crop	Level of Technology[1]	Yield (T/ha)	Labor Requirements (man-days/ha)	Non-Labor Cost (1000 MF/ha)	Non-Labor Cost (1000 MF/T)	Producer Price[2] (MF/kg)	Net Returns to Land, Labor & Mgmt. (1000 MF/ha)	Net Returns to Land, Labor & Mgmt. (1000 MF/T)	Net Returns to Land, Labor & Mgmt. (MF/man-day)
Cotton	0	0.5	140	21.0	42.0	75	16.5	33.0	120
	1	0.9	108	45.0	50.0	75	22.5	25.0	210
	2	1.2	122	45.0	37.5	75	45.0	37.0	370
Peanuts	0	0.7	95	11.5	16.5	40	16.4	23.5	170
	1	1.0	70	19.0	19.0	40	21.0	21.0	300
	2	1.5	82	23.0	15.3	40	37.0	24.7	450
Millet-sorghum	0	0.5	95	2.5	5.0	32	13.5	27.0	140
	1a	1.1	59	7.5	6.8	32	27.7	25.2	470
	2a	1.8	66	21.5	11.9	32	36.2	20.1	550
	1b	0.7	55	7.5	10.7	32	14.9	21.3	270
	2b	1.4	62	21.5	15.4	32	23.2	16.6	375
Rice	0[3]	0.7	53	6.0	8.6	40	22.0	31.4	415
	1Y	1.2	52	26.5	22.1	40	21.5	17.9	415
	2Y	2.0	62	35.5	17.8	40	44.4	22.2	715
	1Z	1.5	76	42.0	28.0	40	18.0	12.0	240
	2Z	2.5	90	48.0	19.2	40	52.0	20.8	575

*Note: The reader should be aware that the significance of this table is limited by the quality of the basic input-output data, which are in general synthetic and not based on farm management research.

[1]0 = Traditional hand-labor methods of production.
1 = Use of animal traction and some other improved practices, e.g., fungicides, thorough weeding.
2 = Use of animal traction plus a full line of recommended practices.
a = Millet-sorghum grown in the Mali-Sud and OACV areas.
b = Millet-sorghum grown in the Operation Mil area.
Y = Rice culture with partial water control --Riz Ségou, Riz Mopti, Riz Sikasso.
Z = Rice culture with total water control -- Office du Niger.

[2]Official prices. [3]Traditional methods using animal traction.

SOURCES: Mali, IER, Coûts Moyens de Production; IER, Mali-Sud, Rapport de Factibilité, Annexe 2; IER, Etude de Factibilité du Projet Riz-Mopti (2ème phase) Annexe A; IRAT, Campagne 1975, Fiche Technique; Unpublished data from IRAT, CMDT, Riz Mopti and Mil Mopti.

C. TERMS OF TRADE AND RESOURCE TRANSFERS

Poor and declining terms-of-trade for agriculture vis-a-vis other economic sectors are often characteristic of developing countries with relatively small secondary and tertiary sectors and with government control of agricultural prices. In Mali, however, this is probably not the case.

If one makes the assumption that the physical productivity of agricultural labor remained relatively constant in the years 1966 to 1975, a product price index series taken from Table 27 can serve as a proxy indicator of changes in the nominal value of a man-day of labour expended to produce various crops.[1] That is, if a man-day of labour produced the same amount of cotton in 1975-76 as in 1966-67, the cotton price increase between these two agricultural years, 121 percent, is a measure of the increase in returns per man-day expended for cotton production. Rises in producer prices for the other crops listed range from 113 to 150 percent.

During the same period the statutory minimum wage rates for urban workers and salaried employees, known as the SMIG, remained fixed for several years. (Table 31, item 5.) Finally in 1973-74 it began to rise. By 1975-76 the minimum wage for unskilled workers was 117 percent higher than it had been ten years earlier. Middle level and university-trained employees did not do nearly so well; their wage rates rose 16 and 15 percent respectively -- though they were undoubtedly helped by job reclassifications and their own upward mobility. Comparison of the agricultural producer price and urban wage indices indicates that over most of the past decade returns per man-day of labor expended in agriculture were probably improving compared to returns to labor

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[1] A second necessary assumption is, of course, that increases in the costs of other factors used in production were matched by increases in productivity of those factors. This assumption is somewhat more questionable than that about the physical productivity of labor. However, it should be valid for the mass of farmers who still use traditional labor-intensive production methods and for farmers using modern inputs who are simultaneously improving management.

Table 31. Selected Price, Wage and Income Indexes for Mali, 1967/68 - 1976/77 (1972 = 100).

	67/68	68/69	69/70	70/71	71/72	72/73	73/74	74/75	75/76	76/77
1. Index of farmer incomes from main cash crops[1]	67	70	91	114	128	100	88	211	259	---
2. Product price indexes (producer level)										
Cotton (unginned)	80	80	90	100	100	100	100	166	166	166
Peanuts (in shell)	80	80	100	100	100	100	100	133	133	133
Rice (paddy)	72	72	100	100	100	100	100	160	160	160
Millet-sorghum	80	80	90	90	90	100	160	160	160	160
3. Input price indexes										
Plows (charrue TM)	50	78	78	100	100	100	100	100	135	193
Drawbar with att. (multiculteur)	51	67	67	100	100	100	100	100	100	267
Cart (1000 kg)	58	78	78	100	100	100	100	100	137	186
Pair of Oxen	58	58	75	92	100	100	117	125	133	250
Cotton mixture fertilizer						100	100	104	142	208
Urea						100	100	100	135	146
Ammonium phosphate						100	100	100	138	238
4. Index of real income of unskilled urban workers	174	165	156	131	109	100	112	131	147	---
5. Index of statuatory minimum wages										
Unskilled labor	100	100	100	100	100	100	136	193	217	---
Middle level	100	100	100	100	100	100	105	111	116	---
University graduate	100	100	100	100	100	100	103	109	115	---
6. Food price index: official prices	58	61	64	77	92	100	123	148	n.a.	---
7. Implicit GDP price deflator[2]		84	89	94	99	100	106	111	132	---

[1]Cotton, peanuts, and rice.

[2]GDP at current market prices divided by GDP at 1969 prices, adjusted to a 1972 base.

Sources: Tables 2, 27; E. Berg, The Recent Economic Evolution of the Sahel, Tables 45, 56, VII-Annex B; World Bank.

in other sectors as a result of tight government control over urban wage rates. Recent changes, however, make it difficult to say whether this situation still pertains.

Another estimate of the terms-of-trade between agriculture and the other sectors can be obtained by comparing the agricultural product price index series with the implicit GNP price deflator series (item 7) in Table 31. The agricultural price index numbers are almost everywhere higher than the associated GDP deflator numbers. This indicates that agricultural prices increased faster during the period than did the prices of other goods and services included in the GDP estimates.

Neither of the above comparisons implies that rural incomes or labor earnings are comparable in absolute terms to incomes and labor earnings in other sectors. This is clearly not the case, as agricultural production (including livestock, fishing and forestry) accounts for only about 64 percent of GDP, although 90 percent of the population is supported by agriculture.[2] However, these comparisons do show an improvement over the last decade in the relative position of people dependent on agriculture for their income.

In fact, the improvement may be more substantial than these comparisons suggest. Much agricultural production is for home consumption, the value of which (opportunity or replacement cost) has kept pace with the price inflation of marketed goods. Moreover, the inflation in food prices (item 6), which depresses the real income of urban workers (item 4), has but little effect on rural residents who produce most of their own food. Also, farmers' gross incomes -- the value of marketable farm output (item 1) -- have increased much more rapidly than has rural population, which is estimated to be growing at less than two and one-half percent per year.

In sum, there is no indication that the agricultural sector has had poor and declining terms of trade with the rest of the economy over the past decade; in fact, the sector seems to have done reasonably

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[2] CNPER, Situation de l'Economie Rurale Malienne en 1972, pp. 3,7.

well at least until 1974. A look at resource transfers, however, may tell another story. There are indications that the government's extraction of an "economic surplus" from the primary sector to provide investment funds for national industries may have become a heavy burden in the last couple of years.

Considering the structure of the economies of Mali and her neighbors, resources for economic development must be found in the primary sector, including mining. But unlike Mauritania, Senegal and Niger, Mali has no mining industry of significance. This leaves voluntary savings in rural areas, terms of trade unfavorable to agriculture, or a net transfer out of the sector on government account (taxation of agriculture exceeding government expenditure benefitting agriculture). The first possibility is impractical and the second does not appear to have occurred as yet. It is not surprising therefore than there is considerable evidence of the third.[3]

When the CNPER examined the rural sector in 1972, it found that the sector was the beneficiary of 3.6 billion MF in government expenditures, including the cost of extension services and various subsidies. The sector returned to the government 5 billion MF in direct and indirect taxes. The CNPER then calculated that the government obtained another 9 billion MF in receipts from derivative industries, particularly through export taxes. It concluded that when these revenues were included the rural sector was contributing 47 percent of government receipts and benefitting from only 14 percent of government expenditure.[4]

In the period since 1972 government subsidies of agricultural inputs have been greatly reduced or eliminated entirely. Producer prices have been officially raised only once. While these prices have remained stationary since 1974-75, the revenues that accrue to

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[3]For a discussion of these alternatives, see Stephen R. Lewis, "Agricultural Taxation and Intersectoral Resource Transfers" in Food Research Institute Studies, vol. XII, no. 2 (1973), pp. 93-114. The FAO Prospective Study found the third method elsewhere in the Sahel: "Another situation common to almost all countries in the Sahel is that the agricultural sector, which contributes between 30 and 60 percent of the GDP, provides more than 10 percent of the state's budgetary receipts but receives an ever decreasing share of them in terms of ordinary budget expenditures. Thus there is a net transfer of budgetary resources to other sectors." FAO, op. cit. (English Summary), p. 21

[4]CNPER, op. cit., p. 7-8.

the government and its agencies from the production of export crops have been growing. We have not been able to bring up-to-date the CNPER's figures on the transfer of resources to the government from the sector. Yet it seems clear from our limited observations that there is a distinct danger of trying to extract too much too soon from a rural sector that was, until two years ago, reeling from the disastrous effects of a drought on incomes that have been among the lowest in the world.

Establishment of Producer Prices

In Mali, two types of calculations have been performed at one time or another to estimate reasonable or just producer prices for agricultural products marketed under price controls. One set of calculations yields estimates of producer reference prices for each produce based on border prices. The procedure differs depending on whether the product is exported or imported. If exported, the value of local production, in raw product units, is calculated by subtracting from the FOB Malian border price all costs of handling, processing, marketing, and transport to the frontier. If the product is imported, transportation costs to Mopti, a major town close to the geographic center, as well as OPAM overhead, are added to the CIF Malian border price. An alternative method, used by IER in June 1976 for the annual price-fixing exercise, estimates production costs with some attempt at using farm budgeting techniques.

Table 32 summarizes (a) the major crop reference prices estimated for the 1974-1978 Plan period by the CNPER, (b) similar estimates made using 1976 world market prices, and (c) the above-mentioned reference prices for 1976-1977 calculated by IER. Also shown in the table are the Plan's recommended producer prices for 1974-75 and 1975-76, and the official prices actually set for these two years.[5]

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[5]We should caution the reader that both the CNPER and IER calculations value labor at 500 MF per man-day. This figure has been questioned by several observers. For example, M.D. Stryker found from investigations in the summer of 1975 that a wage rate of 350-400 MF/day was common in Bamako and that a considerably lower rate would prevail in rural areas on the informal market because of urban/rural cost-of-living differences.

Table 32. Reference prices for 1974 – 1978, producer prices proposed and implemented 1974-75 and 1975-76.

Product	Calculated Reference Price[1]					Proposed Producer Price[1]		Actual Producer Price[2]	
	Malian Border Base[3]		Cost of Production Base						
	1974-1978	1976[4]	1974/75[5]	1975/76[5]	1976/77[6]	1974/75	1975/76	1974/75	1975/76
Seed Cotton	305	164	65/82	99/116	102	75	100	75	75
Peanuts (in shell)	65	54	38/43	47/52	58	40	50	40	40
Rice (paddy)	55-70	50	39/45	52/58	46	42	55	40	40
Millet, sorghum, maize	40-65	--	31/34	35/38	40	32	35	32	32

[1] CNPER, Programme du Secteur, I, pp. 23-32, 37-54 (particularly pp. 30, 31).

[2] Table 27.

[3] See text for method of calculation.

[4] Estimated by the authors, using as base January 1976 world market prices. Sources: BCEAO, Notes d'Information et Statistiques, No. 236, Feb. 76, pp. 10, 12; Marchés Tropicaux et Méditerranées, No. 1583, March 1976, p. 606.

[5] Cost of production with maintenance of input subsidies in effect in 1974/cost of production if subsidies were eliminated. Costs include labor charges, with labor valued at 500 MF/man-day.

[6] IER, Coûts Moyens de Production. Cost of production with input subsidies in effect for 1976/77 and with labor valued at 500 MF/man-day.

The table reveals that there is considerably more margin for raising cotton and coarse cereals prices than there is for peanuts and rice. With regard to cotton, the impact on government revenues of an increase in the producer price need not be negative, depending on the size of the increase and the supply response rate or elasticity. Estimates of this response would require more intensive study, but we suspect that no long-run decrease in government revenues would result from even a relatively large increase in the producer price, say of the order of 30 percent.

In addition to benefitting cotton producers directly and to improving their ability to purchase inputs, a substantial increase in the cotton price would have important secondary effects. It would induce farmers in the Zone Sud and other suitable areas to shift land from cereals to cotton production, thereby creating increased demand for cereals produced in areas not adaptable to cotton production, e.g., the Moyenne Vallée, Delta, and Séno-Dogon Zones.[6] Higher cash incomes among cotton farmers -- and derived demand among other farmers -- could be particularly important in expanding the internal market for rice and specialty crops. An obvious positive effect of increasing cotton prices and thereby production and exports would be an increase in net foreign exchange earnings.

One cautioning consideration with respect to any substantial increase in the cotton price is the limited capacity of existing marketing, storage, transportation and ginning facilities for cotton. (See pages 160-163.) Another is the limited capability for delivering modern inputs.

A generalization which might be drawn from this analysis is that agricultural price increases are essential if needed mechanization, modernization and improvements in labor productivity, which could lead relatively quickly to lowered unit production costs, are to be achieved.

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[6] Although this specialization of production appears desirable from a regional point of view, it should be recognized that it would result in increased cereals prices on the free market in the Zone Sud.

Our observations throughout much of the CMDT and OACV zones lead us to think that a majority of the farmers are already knowledgeable enough to adopt innovations and new technology rapidly, if markets and price incentives are there.

However, as stated earlier, the problems of inadequate rural roads, processing capacity and marketing efficiency -- particularly for export crops -- have to be solved quickly if a severe bottleneck is to be avoided. This caveat probably holds even with current relative prices. The need to correct these problems of harvest evacuation and of market adequacy has received little attention. The government and donors alike have focused on increasing production, usually by increasing physical production capability. Our argument is that the paramount problem of the near future will be markets, not production.

D. RESEARCH PRIORITIES

Among the more overwhelming impressions that one gets in attempting to understand and analyze Mali's agricultural sector is that the answers to most technical, economic and social questions are not known. More forthright officials (and researchers) often admit to visitors that in many areas they have only superficial knowledge because no serious research using good local data has been done. As is clear from the data problems referred to throughout this report, even factual information about resource availability and use, production, consumption, and prices is extremely fragmentary and often based on guesswork.

In this section we outline some research priorities or needs that appear to have potential for a large pay-off in better planning, policy making and extension success.

Technical research has been covered in section I(I). Here we would like to emphasize the particular need for increased research on cultivation techniques, implements and implement use. Mali's agricultural extension program takes animal traction as the basic element for modernization and increasing productivity. However, in our view, the state of knowledge with respect to the physical and economic effects of animal traction remains superficial. To date little systematic research has been done which compares alternative animal-drawn implements under various soil, micro-climate or economic conditions.

Adoption of a single type of plow and auxiliary implement set is now being urged by extension workers throughout the country. Two examples illustrate the probable fallacy of this uniformity:

(1) On the Séno Plain some farmers have used lightweight plows pulled by donkeys for a number of years. The plows, imported from Europe, used to be obtained from a Catholic Mission in the area. Operation Mil Mopti, recently established in the Séno, is now trying to get all farmers to adopt the heavier plow (charrue TM) which is produced by SMECMA and is the standard throughout the country. The heavier plow costs almost twice as much, requires the use of a pair of oxen (150,000 MF) instead of a donkey (30,000-50,000 MF), and adds little or nothing in terms of

increased productivity in the sandy soils which predominate in the area.[1]

Despite continuing demands by farmers for the smaller plow, none are made available. (The Missionary program was always small and has now been terminated.) Extension workers in the field do not appear concerned; they explain that "decisions about what will be extended are made by experts in Bamako."[2] Unfortunately, we were unable to check with the experts in Bamako (the agricultural engineers) our impression that no research comparing the technical or economic productivity of the two plows had been done, at least not under the physical and economic conditions of the Séno Plain.

(2) A second basic part of the extension package is the multiculteur which consists of a wheeled tool bar and plow, cultivator, springtooth harrow and, where appropriate, peanut-lifter. This implement, which can to some extent replace the plow as well as perform other functions, is also extended nationwide. It apparently is well accepted and performs well under most conditions. However, incidental to agronomic research on floating rice, researchers at Mopti have discovered that the multiculteur is too unstable (its one wheel is near the front of the tool-bar tongue) to be used for cultivation of growing rice. Too many rice plants are cut. Yet multiculteurs are still being advocated by Opération Riz Mopti, and no research efforts focusing on this problem are underway.

As these two examples illustrate, serious questions can be raised about the types of mechanical inputs now being extended. The need for research on cultivation techniques (including equipment and its use) has been recognized through the creation of a cultivation techniques section at Mission IRAT/Mali in January 1976. But the section consists of only two agronomists, one Malian and one French. It has received no operating funds.

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[1] We understand that data is available on the use of scarification techniques in the Senegal peanut basin and in the Kaya ORD of Upper Volta. This information could be very applicable to the situation on the Séno Plain.

[2] This reference to authority and continued references to the "conservativeness" of the Dogon (inhabitants of the Dogon Plateau and the Séno Plain) were happily the only manifestations of the "farmers are illiterate and therefore unintelligent" syndrome that we encountered.

Cultivation practice research should also have as essential elements farm management and sociological studies which yield information about productivity under location-specific conditions. Traditional research in Mali (as elsewhere) largely ignores these aspects -- implicitly assuming that new products and techniques which increase production should and will be adopted at whatever cost. This approach seems to require that people adapt themselves to superior technology, rather than technology being designed to adapt to people and their economic and social limits.

Economic research in Mali is mostly macro research and most is superficial and performed by quick missions sent by foreign donors. (Ours is no exception!) Microeconomic research is an important unfilled need that should get attention. A farm management study based upon a field survey in the OACV zone by the IER Evaluation Unit is currently underway. This is a laudable start and should be followed by similar studies. But even more useful would be assignment of agricultural economists to work directly in the Agronomic Research Divison of IER to assist in identifying and evaluating economically productive extension packages. Contrary to common belief, we would suggest that the economics ability of researchers assigned to this role is much more important than in-depth knowledge of agronomy or soil science.

Another research need that deserves emphasis is entomology. Insects are an increasing problem in Mali as land use intensifies and more productive but also more vunerable plants are introduced. For example, new rice strains in the floating rice areas have proven to return handsome increases in yields as compared to native varieties. However, they are also much less resistant to attack by stem borers and other insects. Currently there are no entomologists on the Mission IRAT staff.

Economic research needs other than farm management (discussed above) include research on the price responsiveness of farmers and consumers. Mali is conducting extensive government intervention in the pricing of agricultural products at both farmer and retail levels without good information about the real effects on production or consumption. Perhaps even more important, officials have no information about the probable effects of alternative courses of action.

In a similar vein, research on the economic efficiency of private and, particularly, public spending patterns is needed. What is the pay-off to extension efforts? Would some or all of the money be better spent subsidizing consumers and letting rising agricultural prices stimulate production? Would investment for small irrigation development be more productive sooner than equal amounts spent on large projects? Is flooded rice a better investment than any form of perimeter?[3] What are the income distribution effects of alternative spending decisions? Is it wise to extract from the agricultural sector in order to develop industry, i.e., what is the relative present value of agricultural versus non-agricultural investment?[4] We hope that IER's Evaluation Unit will tackle most of these questions on a national scale.

Most research done with respect to expenditures, public or private, consists of project analysis, which seeks to evaluate or more often justify the feasibility of public projects--for which, in general, a go-ahead decision based on other, non-economic, grounds has already been made. Although project analysis should yield decisions which are economically efficient, failure to use real opportunity costs in analyses (i.e., the real rate of interest), failure to consider alternatives, and eternal optimism about the productivity of projects render most project analyses of dubious value for making resource allocation decisions. This problem is almost universal. For Mali, however, with its severe budget constraints and its need for a fast pay-off from public expenditures, it is more critical than for most other countries.

Another question with both technical and economic aspects is what should be done, if anything, about grain storage. There is currently strong pressure in Mali to increase the cereals storage capacity of OPAM. Increased capacity is seen as necessary if panic purchases of

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[3] The WARDA/Stanford Food Research Institute collaborative study on selected economic aspects of rice should provide part of the answer, as should a study of irrigated perimeters by Purdue University.

[4] With respect to this question we would hazard a guess that it is too early in Mali's development (incomes are too low in rural areas) to justify large diversions to other sectors.

grain from abroad are to be avoided when the next drought occurs. However, insufficient information is available for rational decisions as to how much storage is needed and where it should be located.

Other questions that must be answered before a rational decision can be made include: What are the economics of size in storage facilities? What are the relative losses in large public storehouses as compared to on-farm storage? What is the relative cost of creating a reserve and storing it as opposed to combinations of imports and higher producer prices in time of drought? If a reserve is created what should be its composition? Many of the technical questions about storage should be answered by an FAO/British grain storage project in Niamey, but the economics of the matter very much need to be explored.

Attempts to answer some of these questions are included in a recently completed government report.[5] However, this report is in essence another "étude de factibilité," which uses analytic tools and coefficients to justify a chosen course of action and, it is hoped, attract donor interest. For example, a basic premise of the analysis in the report is that cereals production would fall by 50 percent in a drought year. Available data indicate that during the recent drought, cereals production did not fall by anything like this percentage, even during the worst years, 1972/73 and 1973/74.

If Mali's efforts to increase agricultural production and land productivity are successful, a short-run excess of traditional food crops is inevitable. With the prospects for increasing exports of these crops not particularly promising, research on alternative crops which meet the needs of a wealthier, more urban society is needed. Also, the heretofore rapid increase in adoption of animal traction, if it continues, will make increasing demands on the animal feed base. Research in anticipation of these changing needs could ease the move to a more modern and more diversified agricultural economy. Some start in this direction has begun with the vegetable variety selection under way at Kamenkolé, an irrigated perimeter near Kayes, and with the forage

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[5] Ministère du Développement Rurale, Stock de Sécurité, February 1976.

crop experiments proposed by the 1974-78 plan. These efforts need to be intensified and expanded to include new crops, including such things as edible dry beans and soybeans which can be grown under upland conditions and which might be competitive in export markets. The potential for citrus also needs to be explored by means of both agronomic and economic research.

The nature of most of the changes that are inevitable if Malian agriculture is to modernize involve movement of people and/or large adjustments in work and lifestyles. There is no base of information about the social problems to be anticipated from the changes that will occur. We are unaware of any systematic social research seeking to provide this information, though one does occasionally find works that illuminate what is happening. (See "Evolution and Change within the Traditional Society" in SectionI(E) page 29.) The importance of sociological factors on program implementation is almost always underestimated--as illustrated in Mali by the difficulties encountered in getting adequate labor for sugarcane cutting in the Office du Niger, in getting farmers to meet marketing targets for cereals, and in getting Dogon farmers to accept the advice of extension agents. Another example is given by the village blacksmith (Action Forgeron) program of the CMDT. When first initiated four years ago the program failed miserably. After a year of inactivity the program was restarted with new blacksmiths, this time men from the traditional blacksmith cast in whom the villagers have confidence. In the past two years the program has made great progress and is now a proud success story of the CMDT.[6]

Agricultural Statistics

Attempts to perform macroeconomic research, planning for economic development, or project analysis reveal the major hole in Mali's information base--the lack of good statistical series for agriculture.

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[6]Each of these examples illustrates an attempt to get people and their social institutions to conform to programs rather than designing programs to fit people. See section II(F) for discussion of another aspect of this phenomenon.

Series of extremely dubious quality are pulled together for each new study or analysis.

The official source of agricultural statistics is the Enquête Agricole published by the Direction Nationale du Plan et de la Statistique, in which data collected annually through sample surveys are tabulated. Several weaknesses of this source can be identified:

(1) The data are of questionable validity because the survey sample now used is several years old and probably no longer appropriate.[7]

(2) The survey staff (junior agricultural agents with other responsibilities) are, it is widely agreed, somewhat less than diligent in carrying out their task.

(3) Some of the data collected are of less value than data which are not included, i.e., price data and data on commodity movements. Yet many pages are devoted to detailed demographic data.

(4) Tabulations are broken down on the basis of administrative districts, not on that of the new rural Zones.

(5) The Report for each agricultural year is published several years after the data are collected, e.g., the Enquête for 1972-1973 was the latest one available in June 1976.

In view of the inadequacy of existing data series and the questionable validity of recent Enquêtes, a prerequisite to useful macroeconomic research is the establishment of official data series on resources in agriculture and their use, production and productivity (yields), producer and consumer prices in local and/or regional markets, commodity flows, and consumption patterns. The series should go back ten or more years and should be done on a zonal basis. Then the Enquête must be reorganized and its functions broadened to assure continous updating. The logical entity to be entrusted with responsibility for the Enquête is IER's Evaluation Unit.

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[7] We were told by various officials that: "the data have no better than 30 percent accuracy; no data of sufficient validity for planning are available; the quality of the Enqûete has declined markedly in recent years."

If the Enquête is retained in reorganized form, it must be published in a more timely fashion. Perhaps computerization of the tabulations is necessary. Now everything is done by hand (except final results which are put on cards for mechanical printout). Programming the compilation and tabulation of data would not be difficult, and a computer is avilable at the Development Bank. Labor now expended on the laborious task of tabulation could be used for survey design and verification work.

E. THE DEVELOPMENT OF EXPORT AND IMPORT-SUBSTITUTION CROPS

The 1974-78 Plan adopts four long-term objectives for the rural sector, two of which relate to food and export crops.[1] The Plan's primary concern is the satisfaction of the nation's food needs, but near-equal importance is given to the extraction of a "maximum economic surplus" from the rural sector in order to provide for an increased rate of investment in the industrial sector. The principal source for this transfer is to be meat exports, on the stated assumption that world and especially African demand will continue to increase. Mali's two main export crops, cotton and peanuts, are also expected to make significant contributions.

The purpose of this section is to examine the ability of these and other crops to provide Mali with foreign exchange and resources for investment in the industrial sector. We also discuss the possibility of developing newer crops to serve these purposes.

Peanuts

Peanuts used to be Mali's principal export. There was a sharp decline in the marketing of peanuts in the mid-sixties, however, and Mali's share of the world market fell in the process from 3.5 to 2 percent. Production and marketing levels had begun to recover by 1970. Then the drought years provoked a temporary decline as many farmers concentrated more of their land and labor on cereals and less on their cash crops.

The overall pattern since 1962 has been one of fluctuations in production and marketing levels, while export quantities of shelled peanuts and processed peanuts have remained stationary. As export levels remained low, Mali lost a significant portion of its share of the world market and at the same time changed the composition of its peanut exports to include processed peanut products: oil and oil cake. There is now some question about the export value of these processed products. A recent study maintains that in 1972 exports of peanut oil and oil cake

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[1] Plan, p. 39

earned nine percent less foreign exchange than the raw peanuts from which they were obtained.[2]

Table 33 . Peanut Prices, Production, Marketing and Exports. (Metric Tons)

Year	Producer Price (MF/kg)	Production in Shell	Marketings in Shell	Exports: Shelled Peanuts	Exports: Peanut Oil	Exports: Peanut Oil Cake
1961-62	14	108,000	66,900	41,034	-	1,323
1962-63	14	117,500	73,600	29,719	-	n.a.
1963-64	14	117,000	72,100	47,207	-	n.a.
1964-65	13	90,000	44,800	22,198	-	n.a.
1965-66	13	75,000	27,900	11,711	-	n.a.
1966-67	16	87,500	39,000	17,440	n.a.	5,756
1967-68	24	90,600	30,030	15,851	388	3,123
1968-69	24	102,410	29,400	6,018	2,315	6,444
1969-70	30	129,200	56,610	17,624	4,547	8,316
1970-71	30	156,040	74,410	20,584	5,443	14,447
1971-72	30	152,130	59,580	22,495	3,158	9,192
1972-73	30	134,680	49,980	12,243	3,563	11,912
1973-74	30	132,200	44,060	12,065	1,519	5,167
1974-75	40	188,100	69,820	18,583	1,518	11,000
1975-76	40	205,000	89,000	21,000[a]	n.a.	6,000[a]

[a]1975-76 export estimates from SOMIEX.

SOURCES: OACV; OACV Compte Rendu 1974-1975, p. 9; IBRD; FAO Trade Yearbook 1974; Le Moniteur Africain, October 1976, pp. 11-12.

[2]Stryker and Shepherd: Le Système des Incitations et l'Avantage Comparatif de l'Agriculture et de l'Industrie du Mali. June 1975, p. 81

The return to higher production and marketing levels that first became evident in 1970 and has resumed in the aftermath of the drought is unquestionably due in large measure to the work of Opération Arachide et Cultures Vivrières (OAVC). It is worth noting that the drought seems to have obscured productivity increases induced by the Operation. While peanut marketings fell sharply outside the OACV zone during the drought years 1971-72 through 1973-74, they dipped only slightly within it.[3] In the following year the zone was expanded; subsequent production and marketing increases have been spectacular. OACV officials ascribe at least part of the 1975-76 gains to expectations by farmers that the government would raise the producer price before the crop was marketed. But OACV requests for an increase to 50 MF/kg were not granted. In June 1976 we found real concern among OACV agents and government administrators that the existing momentum toward greater production would be lost if there were no price increases for 1976-77. In fact there has been none. Accordingly, we believe there is a distinct possibility that continued maintenance of the producer price at 40 MF/kg will cut short the increases in marketings and exports that have occurred since the end of the drought.

It is true that the current trend in world prices for peanuts and peanut products does not offer much hope for increases from that source that can be passed along to the Malian peanut farmer. As shown by Figure I and Table 34, world prices for peanut oil and peanut-oil cake have fallen considerably since they attained peaks in October 1974 and December 1973, respectively. Shelled peanuts are now well below the October 1974 price. Nor can a rebound be expected soon. The World Bank's projections (in constant dollars) show stagnation at the current level through 1980 for raw peanuts and a decline of two percent per year through

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[3] Peanut Marketings

(Metric Tons)	1970-71	1971-72	1972-73	1973-74
OACV Zone	46,055	43,396	41,396	40,205
Non-OACV	28,355	15,620	8,584	3,855

Figure I

PRICES OF OIL SEED PRODUCTS, 1973-76

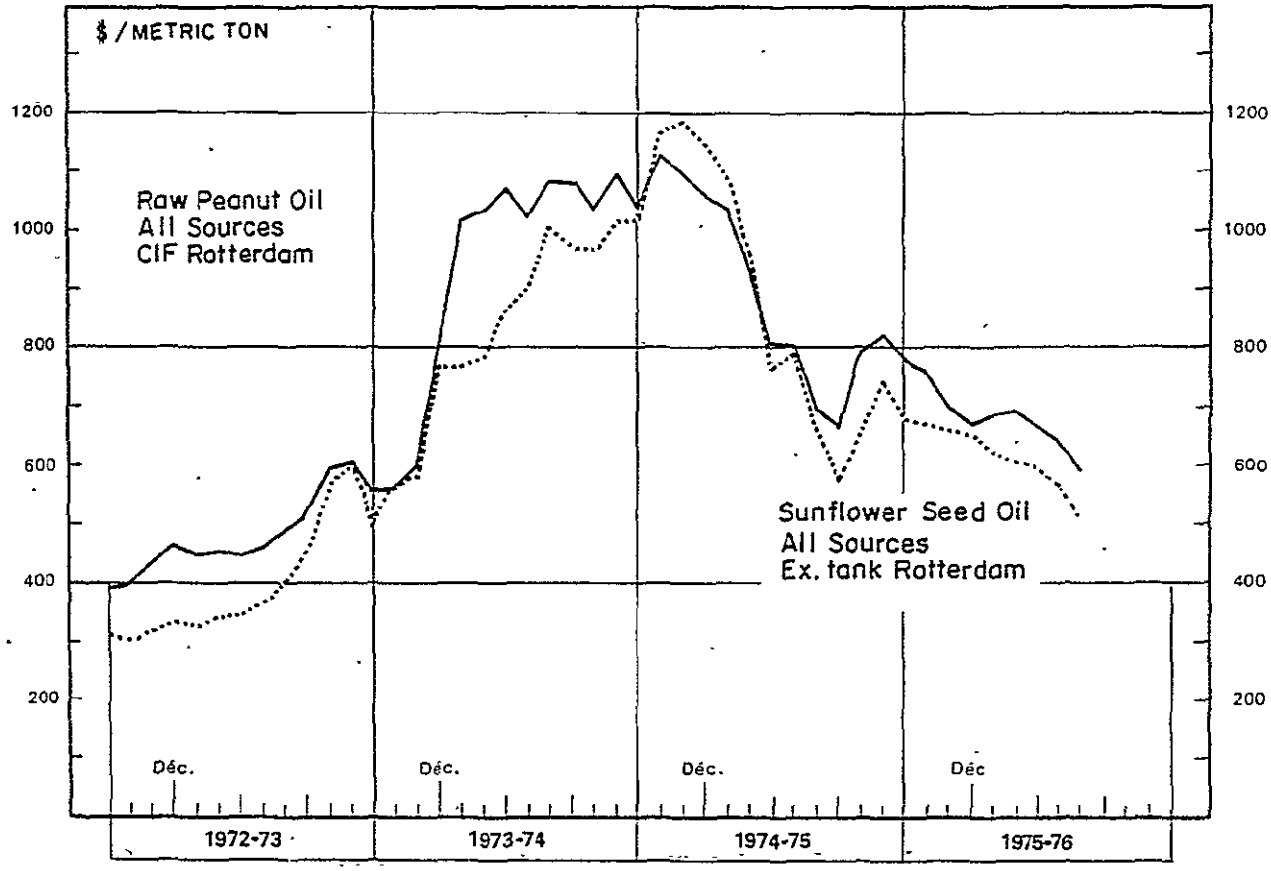

Table 34

Monthly Averages	Raw Peanut Oil All Sources (a)			Sunflower Seed Oil All Sources (b)			Peanut Oil Cake 50% All Sources (c)			Soy Bean Oil Cake 44% USA (a)		
	1973-74	1974-75	1975-76	1973-74	1974-75	1975-76	1973-74	1974-75	1975-76	1973-74	1974-75	1975-76
	U.S dollars Per Metric Ton											
Octobre.....	559	1 117	755	562	1 160	667	202	196	146	207	210	163
Novembre ...	592	1 088	708	577	1 177	657	208	182	139	223	179	152
Décembre ...	791	1 057	669	763	1 146	650	245	173	139	243	184	157
Janvier.....	1 012	1 031	683	764	1 078	623	229	149	135	221	156	160
Février.....	1 030	935	690	780	960	604	187	122	133	203	141	164
Mars.....	1 065	805	669.	850	760	599	172	131	127	200	144	162
Avril	1 019	801	641	897	785	562	157	140	131	172	153	163
Mai	1 079	696	589	997	665	509	154	130	153	157	148	190
Juin.....	1 076	669		970	571		146	135		142	150	
Juillet	1 032	781		965	655		144	145		163	157	
Août.....	1 089	814		1 009	735		179	152		197	170	
Septembre ...	1 035	785		1 011	681*		173	153		184	169	
Average ..	*948*	*882*		*845*	*864*		*183*	*151*		*193*	*163*	

(a) - CIF Rotterdam. - (b) - Ex. tank Rotterdam. - (c) CIF Hambourg. *Revised Figure

SOURCE: Banque Centrale des Etats de l'Afrique de l'Ouest, Notes d'Information et Statistiques, No. 240, June 1976.

1980 for peanut oil. The outlook for peanut oil cake appears brighter because of increasing demand for it for livestock feed.

Since there is little hope offered by world price trends, concern for continued increases in peanut exports warrants a critical look at the numerous charges and taxes that are taken out of peanut revenues before the farmer finally gets his share.

(a) An export tax of 4,050 MF per ton has been unchanged for four years, despite the rise and fall in world prices.

(b) SCAER, whose operations are discussed elsewhere, took 8,936 MF per (unshelled) ton in 1974-75. This is a variable levy that helps to cover SCAER's annual operating deficit.

(c) OACV imposes a tax of 15,380 MF per ton to pay for part of the cost of providing extension and other services, including road repair. Since 1970 the "government" contribution to OACV has come entirely from this tax rather than from the national budget.

(d) Finally, SOMIEX takes a percentage not only to cover its export cost but also to help subsidize consumer imports.

All of these charges and taxes plus the cost of shipping by rail to Dakar (25,224 MF per ton of shelled peanuts)[4] provide some explanation of the large difference between producer's prices in Mali and in Senegal: 40 MF and 83 MF equivalent, respectively. Not having looked into the structure of costs in Senegal, we limit ourselves here to the comment that economic analysis might well be able to estimate the benefits that would accrue to the Malian government and its agencies as well as to the Malian farmer if some of these levies were reduced and the producer price raised.

Cotton

Mali's other principal export crop -- cotton -- presents a brighter picture. Even though cotton production in the Office du Niger declined

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[4]Mali, Ministère des Transports, Etude des Transports Bamako-Kayes, 1976, Annexes, p. III.22.

in the late sixties and was finally abandoned in 1970, the country's total output has risen steadily over the past 10 years, the drought years of 1972-73 and 1973-74 expected. See Table 35.

Table 35. Seed Cotton Marketing and Cotton Exports
(metric tons)

Year	Producer Price	Marketing CFDT/CMDT	Marketing O.H.V.[a]	Marketing O.N.[b]	Lint Exports	Cottonseed Exports
1966-67	34/30*	21,731	-	6,235	10,220	8,603
1967-68	40/35	29,213	667	2,739	11,309	14,000
1968-69	40/35	40,539	350	4,054	14,907	10,148
1969-70	45/35	41,192	474	3,324	14,426	18,989
1970-71	50/35	52,548	213	-	14,323	24,614
1971-72	50/35	67,432	507	-	23,306	18,695
1972-73	50/35	65,560	622	-	21,595	15,111
1973-74	50/35	50,032	838	-	17,462	503
1974-75	75/50	60,092	1,089	-	19,181	7,000
1975-76	75/50	101,000	2,340	-	34,883	25,000

*first/second quality (MF per kg)

[a]Operation Haute Vallée

[b]Office du Niger, which suspended cotton production in 1970

SOURCES: Annuaire Statistique 1972; IBRD; SOMIEX; FAO Trade Yearbook 1974.

The percentage increase in the producer's price for cotton granted in June 1974 was almost twice that for peanuts: 60 percent versus 33 percent. Production recovered quickly from the drought and responded to the new price of 75 MF/kg with an increase from 61,000 T of seed cotton in 1974-75 to 103,000 T in 1975-76.

World prices are for the moment more buoyant for cotton than they are for peanuts. Current prices are not as high as they were in late 1973 and early 1974, but have been moving upward in 1975 and 1976. (See Figure II and Table 36.) The trend may not continue indefinitely. World

Figure II

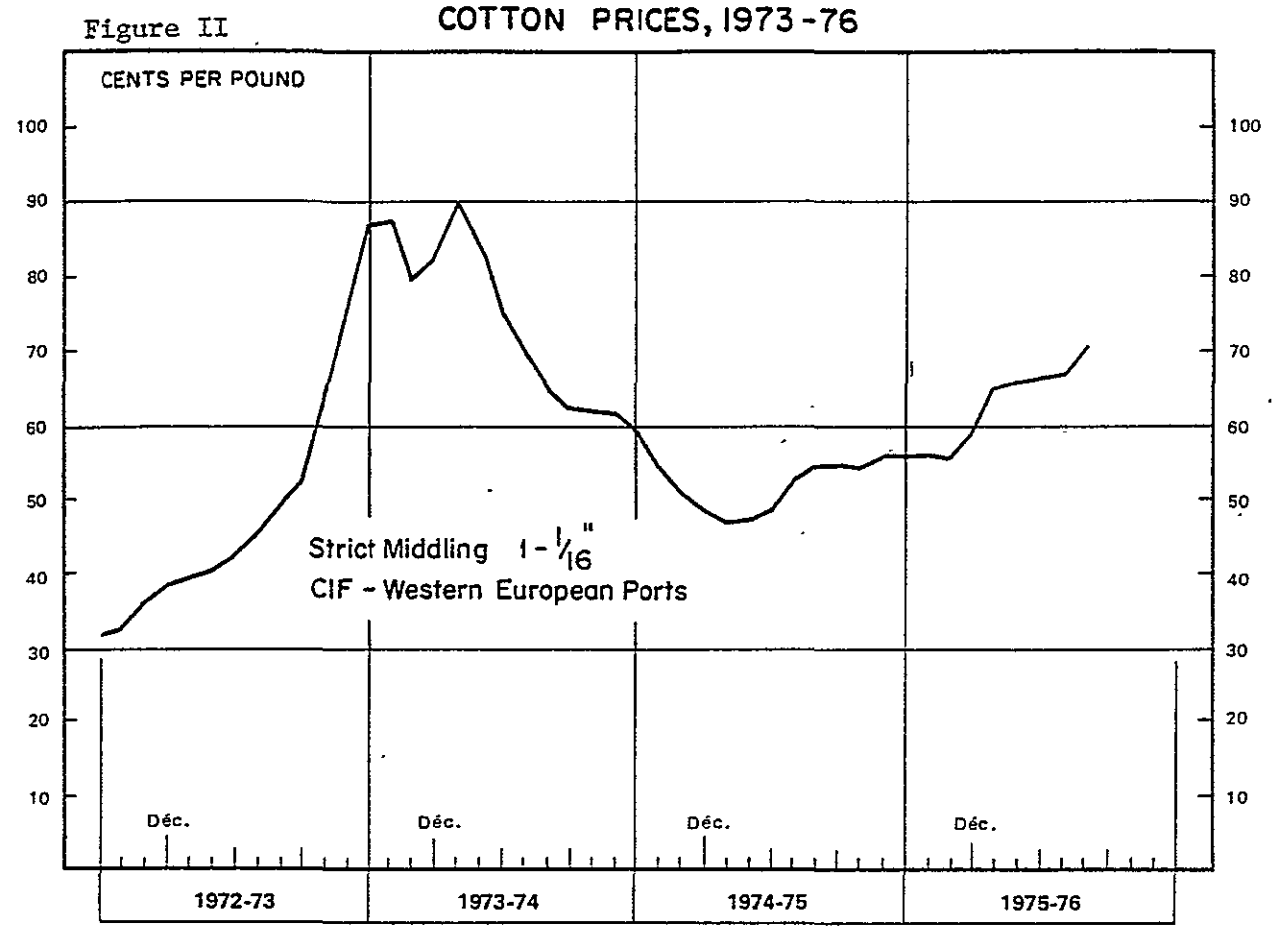

Table 36

Monthly Averages	*Strict Middling 1 - 1/16" CIF - West Europe Ports			Cameroon - Allen 1" To 1-1/32" FOB Africa			Cameroon - Allen 1" To 1-1/32" CIF Europe		
	1973-74	1974-75	1975-76	1973-74	1974-75	1975-76	1973-74	1974-75	1975-76
	U.S. Cents / lb			French Francs / 100 kg					
Octobre	87,33	54,26	55,70	774	505	460	796	535	490
Novembre	79,51	50,70	55,20	683	460	470	705	490	500
Décembre	82,37	48,42	58,60	748	430	500	770	460	530
Janvier	89,11	46,78	64,50	950	410	570	980	440	600
Février	84,16	47,03	65,85	820	393	590	850	423	620
Mars	75,03	48,39	66,20	720	400	610	750	430	640
Avril	70,16	51,96	66,45	710	435	625	740	465	655
Mai	65,01	54,20	70,40	650	450	675	680	480	705
Juin	62,31	54,15		615	420		645	450	
Juillet	62,03	54,06		595	430		625	460	
Août	61,42	55,46		605	445		635	475	
Septembre	58,99	55,36		585	455		615	485	
Average	*73,12*	*51,73*		*705*	*436*		*733*	*466*	

* Index of Liverpool Cotton Services Ltd.

SOURCE: Banque Centrale des Etats de l'Afrique de l'Ouest, Notes d'Information et Statistiques, No. 240, June 1976.

Bank projections (again in constant dollars) show a four percent drop in 1977 and another four percent drop in 1978, with prices then remaining steady to 1980.

Cotton has brought significant earnings to the country. In March 1974, when cotton lint was being exported at an extraordinarily high price (1,050 MF/kg FOB Malian border), CNPER calculated that each kilo of seed cotton produced in Mali earned 194 MF for the government and its agencies, exclusive of CMDT taxes.[5]

Other Crops

What are some other crops that might find a valuable export market, or might displace imports at an acceptable domestic resource cost? Acute balance-of-payments requirements for the development of export and import-substitution crops happily combine with increasing potential for the production of crops of both kinds. In this regard it is probably a safe assumption that as Malian farmers increase their cereals production, they will progressively cut back on land and labor inputs allocated to cereals and devote more of both to the cash crops that seem most advantageous to them.

The 1974-78 Plan foresees export possibilities in the near future only in three specialty products: fruit, vegetables and tobacco. We will discuss these in turn and then address other crops that might either substitute for imports (sugar and tea) or meet internal needs (kenaf fiber and forage crops).

Fruit and Vegetables

Much of Mali's production of fruit and vegetables is consumed by those who grow it or is sold locally in small quantities. The latter is particularly true of the country's prime fruit -- mangoes. The main centers of vegetable consumption are Bamako and Kayes. Vegetable production is limited, not by soil, water or climatic constratints, but rather by the narrowness of the domestic market.

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[5] CNPER Secretariat, "La Politique des Prix et les Coûts des Produits Agricoles," Dossier Principal. March 1974, p. 2. See also: CNPER, Programme du Secteur, I, pp. 43-45.

Exports of mangoes and green peppers have made good progress in the past few years but remain limited, as indicated by Table 37 below.

Table 37. Exports of Mangoes and Green Peppers
(Metric Tons)

	1969	1970	1971	1972	1973	1974	1975	1976
Mangoes	187	254	246	332	383	563	482	450
Peppers	0	6	39	131	211	359	351	590

SOURCE: OPAM, Fruits and Vegetables Division

These figures include exports of mangoes to Senegal through 1974, when they totaled 100 T. Since then OPAM has left the Senegal market to private traders and has concentrated instead on the European mango market. Its principal competitors are Venezuela (which is highly competitive in quality and price), Upper Volta, Ivory Coast and Kenya. All green pepper exports are to Europe where the main competitors during the continent's off-season are Senegal, Cuba, Ethiopia and Morocco. Mali is apparently the second leading supplier of green peppers by air to Europe.

OPAM has set an objective of exporting 550 T of mangoes and 950 T of peppers to Europe in 1978. According to OPAM, the constraints to increased exports in order of importance are: (a) lack of market development for mangoes, (b) airfreight costs, and (c) inadequate means for handling from field to processing site. The cost of freight is reflected in the fact that mangoes are purchased from producers at an average of 75 MF/kg and are delivered to Paris at 500 MF/kg CIF. The Fruits and Vegetables Division of OPAM would like to take the processing and packing

operation closer to the farmer by establishing a number of small packing centers in the Bamako area. (It is worth noting that all mango exports and 60 percent of pepper exports are produced by small holders, and the policy of the Division is to encourage greater productivity on the part of these farmers. The remaining 40 percent of pepper exports come from the state farm at Baguineda.)

A new export vegetable is green beans. Five tons were exported in both 1975 and 1976. OPAM hopes to make it as much as 100 tons in 1977, though keen competition from Senegal and Upper Volta may make the objective hard to reach. Strawberries are being grown experimentally for export, and limes (citrons verts) are under consideration.

Dried onions are an important and growing export through private channels, principally destined for the Ivory Coast. The CNPER gives a figure of 5,112 T of onions marketed in the Séno-Dogon Zone in 1971-72, the bulk of which was dried and exported. This is no less than 39 percent of the total volume of marketed vegetables in that year. Rice farmers in the Office du Niger produce onions on the side and ship them to Upper Volta and Ivory Coast via trucks coming from these countries. This would seem to indicate adequate demand for this product, which lends itself to cultivation and processing by relatively simple and inexpensive means. But in addition to the presence of foreign trucks there are other indications that greater attention could be given to marketing. Problems in this domain are growing.

Tomatoes destined for market are principally grown in the Haute Vallée around Bamako, including Baguineda (1,245 T in 1971-72), and about half that amount is produced and marketed in the Séno-Dogon Zone (624 T). The SOCOMA canning plant located near Baguineda can produce tomato concentrate but has been in technical and financial difficulty for some time and is operating well below capacity. This has discouraged production.

A variety of vegetables are grown on irrigated perimeters along the Senegal River near Kayes. Irrigation is from the river by motor pumps on floating platforms. Until such time as the Manantali dam is built, the Operation des Perimètres Irrigués (OPI), which provides inputs and extension services and purchases output, has been restricted by the multinational Senegal River Basin Authority (OMVS) from irrigating more than 500 ha. In 1975-76 the Operation had eight small perimeters being farmed in half-hectare lots by farm families from nearby villages. The total amount of production marketed through OPI was as follows.

Table 38. Marketed Production of OPI - Kayes, 1975-76
(Metric Tons)

Heads of Lettuce	Cabbage	Potatoes	Small Onions	
15	59	58	10	
Large Onions	Tomatoes	Red Peppers	Okra	Sweet Potatoes
16	16	3	4	5

SOURCE: Opération des Perimètres Irriguées

Tobacco

Commercial tobacco has been produced in the Haute Vallée since 1969 to supply the SOMATAM cigarette factory. The 1974-78 Plan set some very ambitious targets for tobacco production. By 1975-76 it was supposed to reach a level of 2,000 T, of which 1,500 T were to come from the Haute Vallée and 450 T from two new

tobacco-growing localities. With SONATAM requiring only 470 T in 1975-76, this level of production would have permitted export of over 1,500 T. In fact, production in 1975-76 was reported to have been 400 T, with no increase projected for 1976-77.[6] This represents a decline from the peak registered in 1972-73 when 533 T were marketed. We discuss in Appendix B(I) the reasons for farmer disenchantment with tobacco as a commercial crop, at least in the Haute Vallée. It is enough to note here that there is little cause for optimism about the immediate future. Domestic production will have difficulty meeting domestic needs.

While CNPER's Programme du Secteur maintains that Malian tobacco can compete in export markets on the basis of quality and price, its companion volume, Situation de l'Economie Rurale, points out that problems of variety of leaf and of drying technology are apt to be difficult to resolve and is pessimistic about competitiveness in price.[7]

Sugar

The opportunity offered by sugar as an import substitution crop is shown by the following comparison.

Table 39. Sugar Production and Imports 1969-74
(Thousand Metric Tons)

	1969	1970	1971	1972	1973	1974
Imports	13.8	31.0	23.0	22.1	34.0	22.8
Production	4.8	4.6	5.1	4.2	n.a.	n.a.

SOURCES: Annuaire Statistique 1972; IBRD; CNPER, Programme du Secteur, I, p. 211[8]

[6] L'Essor, July 3-4, 1976.

[7] Programme du Secteur, I, pp. 269-72, and Situation de l'Economie, p.8.

There are now two locations in the Office du Niger where sugar cane is grown and milled: Dougabougou and Siribala. The former, covering some 1,200 ha, has been producing since 1966. The Siribala fields are expected to cover 4,000 ha of which 3,000 would be cultivated and 1,000 left in fallow. In 1975-76, 600 ha were actually planted at Siribala. Both areas are irrigated by pump since the fields are higher than the principal canal of the Office du Niger from which they draw their water. The Office is concerned about the increasing cost of pump irrigation and is therefore seeking financing for a new principal canal 19.4 km in length that would make gravity irrigation of both Dougabougou and Siribala possible.

There are two other problems that have led to decline and stagnation in the production of sugar in the Office. Lack of labor to cut and transport cane has caused serious problems. The Office says it needs 6,000 workers at peak periods but has been unable to hire that number.. The area covered by the Office is a resettlement zone where most of the 46,590 inhabitants are tenant rice farmers. The nearest population center where unemployed labor might be found is Ségou, more than 50 km distant. The Office is therefore trying to find financing to mechanize cane-cutting operations. The second problem is the appearance of smut (charbon) in the last few years. If we accept the Plan's assumption that demand for sugar in Mali is income-elastic, it

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[8]The frustration involved in trying to get good statistics is revealed by the following comparison of figures on sugar imports (in metric tons):

	1971	1972	1973
Direction des Affaires Economiques (used in CNPER Programme du Secteur, I, p. 214)	26,851	26,955	21,853
Comptes Economiques de Mali 1971	29,400	-	-
Annuaire Statistique 1972 (includes sugar confections)	26,375	22,533	-
IBRD (from Statistiques Douanières and the Central Bank of Mali)	22,951	22,098	33,988

is apparent that the gap between domestic needs and domestic production will continue to grow, unless an ambitious program is undertaken to develop sugarcane production.

Table 40. Sugar: Projected Demand and Domestic Supply (thousand metric tons)

	1976	1977	1978	1983	1993
Estimated demand	48	50	54	76	149
Projected production:					
Dougabougou	5.4	5.4	5.4	5.8	5.8
Siribala	8.1	13.5	13.5	14.5	14.5
	13.5	18.9	18.9	20.3	20.3

SOURCE: Plan, p. 65.

Actual production at Dougabougou and Siribala in 1975-76 was only 4,260 T, well below the 13,500 T projected.

In the mid-sixties IRAT grew sugar experimentally on the Loutana plain, 40 km north of Sikasso, but the early success of the Chinese sugar project at Dougabougou apparently led to the abandonment of Loutana. Since then it has been devoted to rice production. A second site near Sikasso is at Katioroniba near the paved road leading to the Ivory Coast. The Plan includes a project for the development of 3,000 ha and an adjacent 15,000 T sugar mill to be brought into production by 1980. France undertook a preliminary study of the project in 1975. While Katioroniba would not need pumps for irrigation, the construction of a dam may be costly. Another project of similar size has been projected for the Diré plain, where adequate land and labor are said to be available. One advantage of the latter site would be the fact that it is in the Sixth Region, a heavy consumer of sugar, and would have easy access to river transport for shipment of the final product. A disadvantage is the fact that pump rather than gravity irrigation would be required. Other sites for sugarcane production, including any extension of the areas located in the Office du Niger, will require construction of the Sélingué or Manantali dams before they become feasible.

The question to be asked about embarking on a heavy investment

program in sugar production are clearly those related to costs and benefits. What is the domestic resource cost of saving a unit of foreign exchange on sugar? Would the new mills be competitive with imported sugar?

CNPER used the following comparison of imported and domestic production costs for 1972-73. Unfortunately, there is no indication of the basis for the "ex-factory cost".[9]

Table 41. Comparison of Granulated Sugar Costs (MF/ton)

Imported (1973)		Dougabougou (1972-73)	
CIF Mali frontier:	154,369	ex-factory cost:	155,500
11.1% value added tax:	17,134	Office du Niger margin:	2,000
duty on sacks:	300	internal transport:	6,000
internal transport:	13,000	SOMIEX margin:	26,500
seller's margin:	5,197		
sale price:	190,000	sale price:	190,000

What is interesting about the above figures is that imported sugar, 85 percent of which came from France in 1973, could apparently be landed competitively at the Malian frontier. The difference in "internal transport" costs undoubtedly results from the fact that the sugar mill is closer to Mopti, the central location to which Mali calculates freight charges in order to set uniform prices for the entire country as a matter of equity. If actual costs of delivery to the western Regions (First and Second) were calculated, it is probable that imported sugar from France would be cheaper in those areas.

But France may not be the most competitive alternative to domestic production much longer. The proposed Katioroniba site, for example, is very close to northern Ivory Coast, where the Ivorian Government has

[9] CNPER, Programme du Secteur, I, pp. 216-7. Stryker and Shepherd were unable to obtain direct data on the costs of sugar production; they estimated the ex-factory cost in constant 1971 Malian francs to be 121 MF/kg. They conclude that at the world prices that have existed and are projected to exist in the 1970s, sugar production is much more worthwhile for Mali than it was in the 1960s. Stryker and Shepherd, op. cit., pp. 87-91.

undertaken a major program in sugar production at Ferkéssédougou with export markets in mind. The Ferkéssédougou complex, which had 6,000 ha under cultivation in 1975, will include a refinery as well as a mill. The Ivory Coast plans to have twelve other centers of sugar production eventually.[10] Upper Volta also has ambitious plans for producing and refining at Banfora, near the Mali border. Upper Volta may in fact soon be in a position to export sugar.[11]

We believe that Mali will want to examine actual production costs closely to evaluate potential social costs and benefits before embarking on an ambitious program to substitute domestic production for sugar imports.

Tea

Malian tea was introduced experimentally by the Chinese in the mid-sixties and is now produced commercially at the Farako plantation near Sikasso. Only 20 T of tea were grown in 1971-72, but about 80 T were grown in 1975-76. The perimeter is said to have the capability of reaching 300 T by 1977-78.[12] Even so, this will cover only one-quarter of the country's estimated demand in 1978. The Plan envisages doubling the size of the present plantation and creating four other plantations, each with a capacity of producing 300 T in order that Mali's internal demand be completely met by 1983.

Kenaf

Kenaf fiber (dah), traditionally used for making fish nets, is now grown commercially by smallholders in Zones Sud, Moyenne Vallée and Delta. A development program for kenaf was begun in 1968. The project provided extension services and selected varieties to farmers, most of

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[10] Ambassade de Cote d'Ivoire aux Etats-Unis, "Le Mois en Cote d'Ivoire", May 1976.

[11] Banque Centrale des Etats d'Afrique de l'Ouest, "Notes d'Information et Statistiques", No. 235, January 1976.

[12] Ministère du Développement Rural, Opération Thé de Sikasso, May 1976, "Ferme de Thé de Farako," p. 2.

whom grow it on very small plots since it requires large labor inputs for harvesting and retting (soaking to separate fiber from stem) in November when other crops are also being harvested. Commercial production grew from 630 T in 1972-73 to 1,300 T in 1975-76.

The World Bank is now considering the provision of credit for a Mali-Sud project from 1976-80 which would include a kenaf subproject aimed at (a) increasing the acreage devoted to kenaf from 2,000 ha to 4,600 ha and (b) improving the retting process. The kenaf grown in Mali is said to be of good quality and might eventually be exported once domestic demand has been satisfied. The price to the producer has been unchanged since 1968 at an average of 91 MF/kg. Even if it were raised 10 percent, the cost of domestic kenaf to SOMASAC, the sack factory at San, would be some eight percent less than the cost of imported kenaf from Bangladesh, CIF San.

Domestic kenaf production fails to meet the requirements of SOMASAC at the present time; and the factory itself, with a capacity of 1.6 to 2 million sacks a year, is able to meet only one-half of the current demand. Agricultural products are customarily transported and stored in sacks rather than in bulk. With production increasing, sacks have been lacking, and this relatively simple item has seriously hampered certain marketing operations, particularly those of OACV. In fact, at an interministerial meeting in July 1976 some of the Operations expressed concern about the situation they will face in 1977. As a result they were able to get permission to import sacks for the 1976-77 campaign if they took the full output of SOMASAC.[13]

Forage Crops

The 1974-78 Plan underlines the long-term importance of forage crops for the production of livestock, but it also recognizes some of the difficulties inherent in introducing it on a significant scale. The Plan admits that adapted varieties are not yet known,[14] though it does

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[13] L'Essor, July 3-4, 1976.

[14] The 1975-76 Mission IRAT report states there is a need to start selecting forage varieties of cowpeas (those that produce abundant greens) in 1976. p. AMS - 20.

say that bets are on stylosanthes gracilis, which has also been cited as a possible crop for the proposed USAID project in the Haute Vallée. Furthermore, the Plan points out that the Malian farmer is unaccustomed to the idea of forage crops and it will require some years of successful pilot projects to convince him of its usefulness. One crucial problem is that while annuals can be harvested, perennials have to be protected against uncontrolled grazing by livestock in the dry season. A sector chief told us that it would take government intervention to protect those growing perennial forage crops against livestock depredations.

In addition, the FAO Prospective Study on the Sahel makes an interesting point about the economics of intensive forage production. According to the summary report, "Economic studies show that up to the present the cost of a fodder unit produced by an intensive system oriented mainly toward fodders is higher than that of a fodder unit derived from cereals or agro-industrial by-products. The attraction of such production lies more in the agronomical advantages brought by introduction of fodder crops into rotation, and in the possibility of suitably feeding draft animals, than in fodder production itself...".[15]

Nonetheless, Mali's intention is to move ahead on three fronts. Least resistence can be expected in restoring and expanding the cattle-forage areas (bourgoutières) in the Delta and Lacustre Zones. At the same time, there is a desire to devote 1,000 ha of the Office du Niger to forage crops and to create similar expanses at Baguineda and on irrigated perimeters near Gao. The third front will be largely an experimental one in the rain-fed zones to the South and West where farmers are apt to be skeptical.

In fact, some experiments are already underway. Small amounts of selected cowpea seed have been distributed in the OACV zone with the idea that when it flowers that part of the crop will be harvested for animal forage and the remainder will produce cowpeas for food and seed.

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[15] FAO, Etude Prospective pour le Développement Agricole des Pays de la Zone Sahélienne, 1975-1990. English summary of the report, p. 59.

The desire of OACV agents is that farmers should start growing cowpeas as a pure crop rather than mixed with other crops as is the custom. Results from experiments at Ahmadu Bello University at Zaria, Nigeria, on the other hand, indicate that it may be better to grow cowpeas in association with other crops.

Whatever problems remain to be resolved, the attention now being given to forage crops indicates that the importance of moving toward integrated farming operations has been recognized.

F. PHILOSOPHY OF AGRICULTURAL EXTENSION

Since agricultural manuals prepared by the ILO projects are often the only documentation available to extension staff, it is possible to talk about a common philosophy of agricultural extension for all the Operations in Mali. According to an outline prepared by the ILO MLI - 72/006 project, agricultural extension is a form of technical education which teaches farmers to understand and apply new ideas and techniques in order to improve their agricultural production. In order to achieve this objective, the future agent is reminded to be sensitive to the sociological and cultural aspects of technical agricultural problems. He is urged to determine the needs of the rural population and to work with rural youth associations as a means of gaining acceptance for improved techniques. Furthermore, the future agent is encouraged to stimulate demand for consumer goods by farmers while improving their agricultural productivity.

Agents in the field (moniteurs) faithfully reflect the principal lines of this philosophy, as indicated by the following responses to the question, "what is agricultural extension?":

Moniteur, Action Riz-Sorgho:	"Agricultural extension is to show farmers modern agricultural methods, to help them understand better and to show them the advantages of leaving old ways and adopting new techniques."
Moniteur, CMDT:	"Agricultural extension is to improve rural life."
Moniteur, Operation Riz-Ségou:	"Agricultural extension involves increasing agricultural production and improving the socio-economic condition of farmers."
Moniteur, OACV:	"Agricultural extension is a method of introducting new techniques."

Conspicuously absent from these personal philosophies of agricultural extension is the notion that extension begins by being responsive to the farmer's situation. On the contrary, as expressed by the head of the

extension service in one Operation, extension begins by presenting the results of agronomic research to farmers and then employing the most appropriate teaching methods in order to get farmers to understand, accept and apply the proposed innovations. This philosophy is not unique to Mali. It is a common feature of the theory and practice of agricultural extension throughout French-speaking West Africa. Making the farmer the object, not the agent, of agricultural development is unlikely to sustain significant long-term increases in agricultural production. Nor, we think, is it an effective approach to rural development.

This philosophy justifies, supports and sustains a highly centralized command-type structure for implementing agricultural extension programs. While the structure adequately provides inputs for farmers and support to extension agents, it also discourages efforts to adapt extension topics to local exigencies. While the Operations do place moniteurs and encadreurs in direct contact with farmers, the rigid organizational hierarchy obliges the moniteurs and encadreurs to be more responsive to administrative requirements than to farmers' problems. If moniteurs practice adaptive techniques, they adapt extension themes only in marginal ways in order to be able to present satisfactory weekly progress reports.

The technical packages or extension topics introduced by the Operations do not require the strict acceptance and rigid programming demanded by packages based on high-yielding varieties. Most of the packages seek only to improve current practices. Thus it appears that the long-term success of the Operations might be more secure if, contrary to the present approach, they gave agents the flexibility to adapt and introduce topics on a farmer-specific basis. Before this technique could be successful however, moniteurs and encadreurs would need to be trained to work with the farmer's total farming system. Agricultural extension in Mali remains crop specific, despite the popular notion that agents are polyvalent. Furthermore, women are usually excluded from extension activities except in the case of Riz Sikasso (which is part of Mali Sud). Consequently, the major difficulties encountered by agricultural agents arise from their insensitivity to the additional labor and time demands

required for the successful application of some extension themes. It is the rare agent who advises farmers how to schedule plowing and planting according to his crops, available labor and field location. This situation is not surprising. The systematic collection and use of micro-level farm management economic data is just beginning in Mali, and future agricultural staff are taught very little specifically about Malian agriculture.

While most extension agents need to improve their professional capabilities, the absence of clear lines between their personal and professional roles places moniteurs and encadreurs in close contact with most of the farmers in their districts. Villages usually provide housing for the agents, and often as the only person in the village who is literate in French, the moniteur or encadreur may act as a spokesman for the village to the district administration on business matters. Farmers often come to the agents' houses to seek agriculturally-related advice and information or to discuss what they have heard on the radio concerning national and international events. Furthermore, moniteurs and encadreurs establish a variety of personal economic relationships with farmers. The development of these relationships is facilitated by the relatively low turnover at this staff level.

One way to begin to explore these relationships and also to understand why agents prefer to work with larger farmers, is to look at the relationships between the moniteurs and encadreurs' field holdings, work animals and agricultural equipment.

A recent survey of 38 moniteurs and 36 encadreurs by R. James Bingen near Ségou revealed the following breakdown.

	Moniteurs		Encadreurs	
	Yes	No	Yes	No
Personal Field	25	13	27	9
Work Animals	4	34	3	33
Agricultural equipment	5	33	5	31

As this table shows, while many extension personnel may have personal fields, they may have neither the animals or the equipment to work them. This creates ideal conditions for the extension agent to enlist the support of the larger farmer who has animals, equipment, and usually labor available. For the agent, working with the larger farmer not only is a relatively easy way to attain respectable production figures in his area; it also permits him to ask the farmer to help cultivate his (the agent's) field in return for cash or perhaps inputs that he can make available.

Extension agents also provide an informal means of promoting agricultural production through their participation in village age-group work societies or tons. Although the agents do not have the time to participate in the field work performed by the ton, they may often substitute a variety of agricultural supplies or equipment for their presence.

G. Planning and Policy-Making

There is no simple or obvious way to assess the effectiveness of a policy-making and planning system. Even if there were, it would be foolhardy to attempt such an evaluation without far longer and deeper study than we were able to undertake.

The difficulties and risks inherent in making assessments of this kind notwithstanding, it is hard to avoid the conclusion that Mali's economic planning and policy making system displays unusually severe inadequacies. Some of the indications of these inadequacies are crudely aggregative in nature, based on rough comparisons of economic growth performance in Mali and in neighboring states and on general appraisal of how Mali's policy makers have responded to the country's evolving economic challenges. Other indications are more 'micro' or 'structural' in nature, involving in particular the degree to which economic analysis and information are brought to bear on planning and policy decisions.

First of all, according to some widely used data, Mali's performance during the 1960's was the worst of all the Sahel countries. FAO analysts, using ECA aggregates which they judged to be the most reliable set of data available, attribute to Mali a 1960-1970 GDP growth rate of 0.2 percent per year. This compares with 0.5 percent for Chad, 0.8 for Senegal, 3.5 for Niger, 5 for The Gambia, 6 for Upper Volta and 7 for Mauritania.[1] According to these same data, average 1970 agricultural income per head was much lower in Mali than anywhere else in the Sahel (US$22 in Mali as against $28 in Upper Volta, $36 in Chad and $73 in Senegal); more to the point, average rural income fell by about one-third in Mali during the 1960's, much more than in any other Sahelian state.[2]

Too much weight should not be put on these numbers, especially

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[1] FAO, Etude Prospective , Vol. I: Rapport Principal, p. 12.

[2] Ibid., p. 17.

since other GDP estimates show Mali's performance as rather better.[3] They are nonetheless suggestive, and they are in accord with the casual observation of many knowledgeable people.

Another indicator of poor aggregative performance is the apparent inflexibility characteristic of recent economic policy. For about a decade, Mali has faced more or less the same set of economic problems. The 1970 IBRD Report on Mali notes, for example, that the new (post-1968) Malian Government took some constructive measures: it increased farm prices, gave an increased role to private traders, hired a French accounting firm to look at state enterprises. But the report then lists "many other steps" which the Government must take to rehabilitate the economy, including the following:

(a) reschedule the external debt;
(b) balance the budget;
(c) liberalize the price structure, removing unworkable controls;
(d) improve performance of public enterprises;
(e) reduce the balance of payments deficit; and
(f) modify the policy of employing all graduates.

These observations were made in 1969. But the list of steps necessary to rehabilitate the economy is the same today. Only on debt rescheduling has there been significant forward movement, and even in this respect there has been movement but perhaps not much change, since the debt owed to communist countries was apparently rescheduled, or - more likely - dropped in 1975, but Mali has accumulated huge new obligations to France. Throughout the 1970's, budget and balance of payments deficits have grown, key price controls have remained in place,

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[3] Cf. République Française, Ministère de la Cooperation, Economie, Emploi et Formation: Evolution et Perspectives pour 14 Etats Africains et Malgache, 1, Evolution du P.I.B. 1950-1970, Perspectives 1970-1990 (Sept. 1974). Estimates of Sahel country growth rates from six different sources are set out in this work; in five of the six, Mali's 1960-1970 growth rate was higher than the median growth rate in the Sahel countries. Contrary data, in line with the argument in the text, are found in W. I. Jones, Planning and Economic Policy: Socialist Mali and her Neighbors, p. 392.

the legal position of traders has remained ambiguous (the official liberalization of trade in 1968 proved transient); public enterprises are in worse trouble than ever; government policy toward employment of graduates remains as it was.

There are many reasons for these persistent policy difficulties, not least of which of course is the incidence of the drought. It nonetheless remains true that these problems persist, that they in fact grow more acute over time without apparent policy response, and they are not found in comparable degree in neighboring Sahel states.

Problems of Planning and the Planning Process

As in almost all LDCs, economic planning in Mali has a number of weaknesses which reduce its impact on actual decision-making.

The plans, first of all, are too big in size. This has been true of all of Mali's plans. During the first post-independence plan, for example (1961-1965), actual expenditures were under 60 percent of planned expenditures in the revised plan -- US $187 million, acutual spending as against US $313 mn planned. In agriculture the actuals were less than half the planned amount.[4]

Mali's second plan was the Three-Year Program of Economic and Financial Rehabilitation (June 1970 - June 1973). This plan originally envisaged investment expenditures of 78 billion MF ($115 mn), but was shortly raised to 116 billion MF (US $232 mn). Aggregate financing obtained during this period was about 80 percent of the planned total investment; actual spending was about 40 percent.[5]

Table 42 below shows the expected amount, allocation and phasing of the investments included in the latest, 1974-1978, plan. Total planned investment over the five-year period is 395 billion MF (about $US 832 mn). Of this total, 133 billion MF is assigned to rural

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[4] See W. I. Jones, op. cit., p. 358. The early post-independence planning process, and the first plan, is extensively discussed by Jones.

[5] République du Mali, Direction Générale du Plan et de la Statistique, Rapport d'Execution du Programme de Redressement Economique et Financier 1970-1973, Décembre 1973, mimeo,; and Plan, p. 31.

development: 97 billion for agriculture (crop production) 22 billion MF for livestock, 5 billion MF for fisheries and forestry, and 9 billion for pre-investment surveys.

These are the original expenditure targets in the Plan, as framed in mid-1974, and using 1974 prices. (The Plan also gives its targets in 1972 prices; prices are assumed to have risen 25% between 1972 and 1974.) In Malian planning, as in Francophone planning systems generally, the original prévisions are changed (i.e., increased) early in the 'execution' of the plan, as better project information becomes available and -- especially in recent years -- as price levels rise. The IBRD, for example has estimated recently that the general price level increased by 40 percent between the completion of the document (early-1974) and early 1976. This would put the estimated 1976 total cost of the public investment program at 550 billion MF ($US 1.1 billion), and if agricultural project costs can be assumed to have risen in line with other prices, the cost of the agricultural program in the Plan would now be an estimated 186 billion MF.

In the Mali planning exercise 1974-1978 there was an additional factor making for revision: the agricultural sector planning commission (CNPER) continued its deliberations well after the general plan was finished and published. The CNPER initial report was adopted in June 1974, along with other sector reports, and the Plan document was issued in August 1974. But the CNPER continued to work from July to December 1974 on project definition and preparation, and from January to April 1975 on completion of pre-investment studies. The estimate of total spending on agricultural development which is found in the final CNPER document, is 228 billion MF, almost double the published Plan figure.[6]

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[6]The Final Report of the CNPER gives a total expenditure estimate for rural development of 228 billion MF including taxes; 200 billion excluding taxes. These figures include recurrent costs needed to bring projects to the producing stage. Fixed investment more traditionally defined is estimated at about three-quarters of total spending, or 171 billion MF. Even if the original Plan included no recurrent expenditure, the CNPER figure is thus about 30% higher than the figure in the general Plan document. Programme du Secteur, I, p. 18.

Some indication of the extent of overreach represented by these numbers is available in a report on plan execution as of December 1975, which was done in the Planning organization.[7] According to this document, the total Plan size is now (mid-1976) 510 billion MF of which 35 billion is intended to be financed from domestic sources and 475 billion from foreign assistance. At the end of December 1975 -- a year and a half into the new plan -- financing had been acquired for 30 percent of this new total, or 155 billion MF, of which 146 billion was external and 9 billion internally-raised.[8] In the agricultural sector, financing had been acquired for 28 percent of planned investment -- three quarters of it in two projects -- 12 billion MF from China, for the Office du Niger, and 9 billion MF from the European Development Fund (FED).

All of this refers to "financing acquired", which is defined as agreements which have actually been signed, or financing for which government has made commitments ("engagements") to the donor. Actual spending is much slower, and physical execution slower still. This means that while in terms of financing acquired the spending targets in the original Plan are near achievement, actual execution levels will be much below those specified in the Plan. And given the shifts in sectoral distribution which seem to have taken place, this close relationship between the aggregate investment targets and "financing acquired" is probably more accidental than anything else.

Mali's plans, then, have been consistently too large in size. Well-known disadvantages flow from having plans that are too big. Lack of realism of goals reduces the credibility of the document in donor

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[7] Direction Générale du Plan, Le Plan Quinquennal au 31 Decembre 1975, Deuxième Partie, Etat de Financement Acquis (February 1976), mimeo.

[8] The 146 billion MF of aid came from the following sources: IBRD, 24 billion; Germany 18 billion; China 18, FED 15; Arab sources 14; Italy 10, France 8; US 8; USSR 7; UNDP 5; ADB 5. Of the 9 billion MF of locally-raised resources, 5 billion was from the Operations, 1.4 from the general budget, 1 billion from the road fund. The percentage of financing acquired by sector was 28% for rural development; 45% for secondary industry; 25% for communication and 20% for social services.

circles, a potentially troubling deficiency since donors are the main consumers of plan documents. More important, such plans tend to lose whatever priority-setting influence they might have. When investment targets are clearly unreachable, decisions on the allocation of available resources must be made independently of the plan -- usually by the Finance Ministry, and generally on criteria only accidentally related to development priorities: speed of project execution, competence or political power of spending agencies, foreign donor preferences.

Table 42. Total Investment, Sectoral Distribution and Phasing, 1974-1978 Development Plan (billions of MF)

	Year					
Sector	1	2	3	4	5	Total
Rural Development	15.7	28.5	30.5	31.6	26.8	133.0
Secondary (industry, mining, etc.)	19.5	25.2	14.4	23.5	27.9	110.6
Communications, Housing, Urban development	21.9	24.7	26.3	22.0	19.0	113.9
Social Services	12.1	9.0	5.9	5.1	5.5	37.7
TOTALS:	69.2	87.5	77.1	82.2	79.2	395.2

SOURCE: Plan, p. 393, errors due to rounding.

In addition to problems related to plan size, Mali's plans suffer -- as do most plans -- from inadequate attention to projects -- their definition and screening. Many of the projects in the plan tend to be inadequately defined and studied and few projects are rejected because of poor conception or low priority. Largely because foreign aid is so large a share of total planned expenditure, the purpose of the planning exercise is to put together as extensive and

persuasive a list of projects as is possible. The process of project agglomeration becomes the essential; screening for project quality during the planning process takes on a much lower order of priority. In the 1974-1978 planning exercise, for example, there was wholesale incorporation of project proposals, in the agricultural sector as in the others. Nowhere does it seem that serious macroeconomic limits ("envelopes") were set out defining spending limits so as to induce the sectoral commissions to reject project proposals of dubious or low priority.[9]

Because of its large size and poor project definition, it is difficult to believe that the planning exercises and the plan documents have had much influence on actual decisions about policy or about project and program priorities. The agricultural planning effort for the 1974-78 Plan, for example, was uncommonly intensive. The CNPER staff put together a collection of data on Mali agriculture which, in terms of scope and detail, has no match in the other sectors. And much of this information and energy was focused on projects, more than in the past and more than in the other sectors. The reward for this effort appeared to be a recognition of agriculture's priorities in the overall Plan, and a hope that because the sector plan was project-focused, the rate of acquisition of financing and of execution would not lag as badly as it had in the past.[10]

In fact, for various reasons, the meaningfulness of the agricultural sector effort appears to have been reduced. First of all, within the agricultural sector, the CNPER effort neglected investment in the two areas in which Mali has strong advantages -- livestock and cash export crops (cotton and peanuts). Drafted in the shadow of the drought, the Plan is dominated by preoccupation with food crop production, especially irrigated rice. In the original Plan 97 billion MF

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[9]The CNPER Final Report comments: "The overall financial envelope, which was rather high, nonetheless was in no way modified by the Conseil Superieur du Plan, and was adopted as such." Situation de l'Economie Rurale, "Presentation Generale du Rapport." The CNPER refers to a number of "arbitrages" which occurred within its deliberations; it was very difficult however to find anyone connected with the planning exercise who could give examples of rejected projects.

[10]In the original Plan document, agriculture received one-third of total planned investment.

was allocated to crop production, of which 55 billion (60 percent) is for staple food crops. Eighty-five percent of food crop investment is for irrigated rice. Only 23 billion MF is planned for livestock, less than 6 percent of total investment in an important and promising sub-sector. And the need for attention to export crops has emerged much sooner than expected, as Mali was moved more quickly than anticipated toward food self-sufficiency.

Secondly, and more important, there has apparently taken place since 1974 a significant reallocation of planned expenditure. The Planning Directorate document mentioned above outlines a new distribution of planned expenditure as follows:

Table 43. Planned Investments, 1974-1978
(billions MF)

	1974-78 Plan (Original Investment Estimates)	Percent of Total	Planning Directorate Revision 1976	Percent of Total
Rural Development	133	34	145	28
Mining, Industry, Water and Energy	111	28	130	25
Communications and Housing	114	29	181	36
Social Services	38	9	54	11
TOTAL:	395	100	510	100

Planned increases on rural development investment as spelled out in the CNPER Final Report have apparently not been incorporated in this Planning Directorate revision. Moreover, as of the beginning of 1976, financing for only 28 percent of planned rural development investments had been acquired, half as much as in the secondary industry sector.

Absence of Policy Analysis

The CNPER planning effort for the 1974-1978 Plan had an additional

feature of some importance: it addressed itself squarely to the issue of farm prices and argued strongly for an increase in producer prices as essential to expanded production. The detailed policy analysis used in the CNPER report to support the argument for higher producer prices is very rare in planning documents -- and indeed, in Mali, does not seem to have any precedence. The fact that producer prices were indeed raised in 1975, by the amounts recommended in the CNPER report, is evidence of its importance. The producer price episode underscores also the rarity of this kind of analysis. Much more important in fact than the looseness of planning is this absence of analysis in the policy-making process. Malian officials concerned with agricultural policy, as well as those concerned with general economic policy, repeatedly mentioned that policy analysis is not common within the government, that there exist few formal procedures, few institutions, which encourage reasoned appraisal and debate of alternative policies. At inter-ministerial councils, meetings of the National Price Commission and similar bodies, notes, memoranda, policy papers are very rarely available, thereby depriving the decision-making process of access to systematic information and ideas.

In 1972 the then Minister of Finance decried what he felt to be one of Mali's principal problems: "the making of important decisions without the benefit of any quantitative estimates of the costs and effects of the choices made."[11] The problem remains the same in 1976.

Mali of course shares this unhappy characteristic with other LDC's; the degree to which economic analysis and information is brought to bear on policy decisions is indeed inversely related to degrees of development. Nor are the reasons for it obscure: principally a lack of staff and sparsity of procedures and institutions conducive to utilization of information and analysis.

The lack of trained economic analysts, for example, is apparent in the central organs of government; the Planning Directorate and the

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[11] République du Mali, Budget d'Etat, 1972, Recapitulation Générale.

Budget office are, for example, very thinly staffed. In the agricultural sector the scarcity of policy analysts, particularly economists, is even more pronounced.

Within the Ministry of Rural Development there are two main places where economic analysts are or have been present -- OMBEVI (for beef and cattle problems) and the Institute of Rural Economy (IER). There are in OMBEVI several Malians with some economics training, as well as a technical assistance team from the UNDP. (See Organization Chart of the Ministry, Figure III). But IER, which is in principal the locus of all rural-development-related studies, has very few economists.

The organization chart of IER (Figure IV) shows the anticipated (1977) revised structure of this agency. The main innovation will be the creations of a Direction de Planification, composed of the present Evaluation Unit and a general planning unit. This Planning Directorate will hopefully have several economists on its staff. At present (late 1976) there are in the Institute four Malians with economics training. Three received their training at the Ecole Nationale d'Administration in Bamako; one is a Belgian-trained agronome with some economics training. But there are no professionally-trained agricultural or general economists. Nor is it clear how many such economists are in training; the number does not seem to be large. The IER has of course a general manpower problem.[12] It is the agency responsible for all agronomic research and is the technical support unit for the entire Ministry of Rural Development. In 1976 its professional staff was as follows.

	Senior Staff	Junior Staff	Total
Technical section	1	--	1
Agriculture	3	3	6
Livestock	2	2	4
Planning	1	1	2
Evaluation	1	1	2

[12] cf. République Française, Ministère de la Cooperation, Project de Restructuration des Cellules de d'IER (Rapport de A. Chavancy, February 1976, mimeo).

Ministry of Rural Development

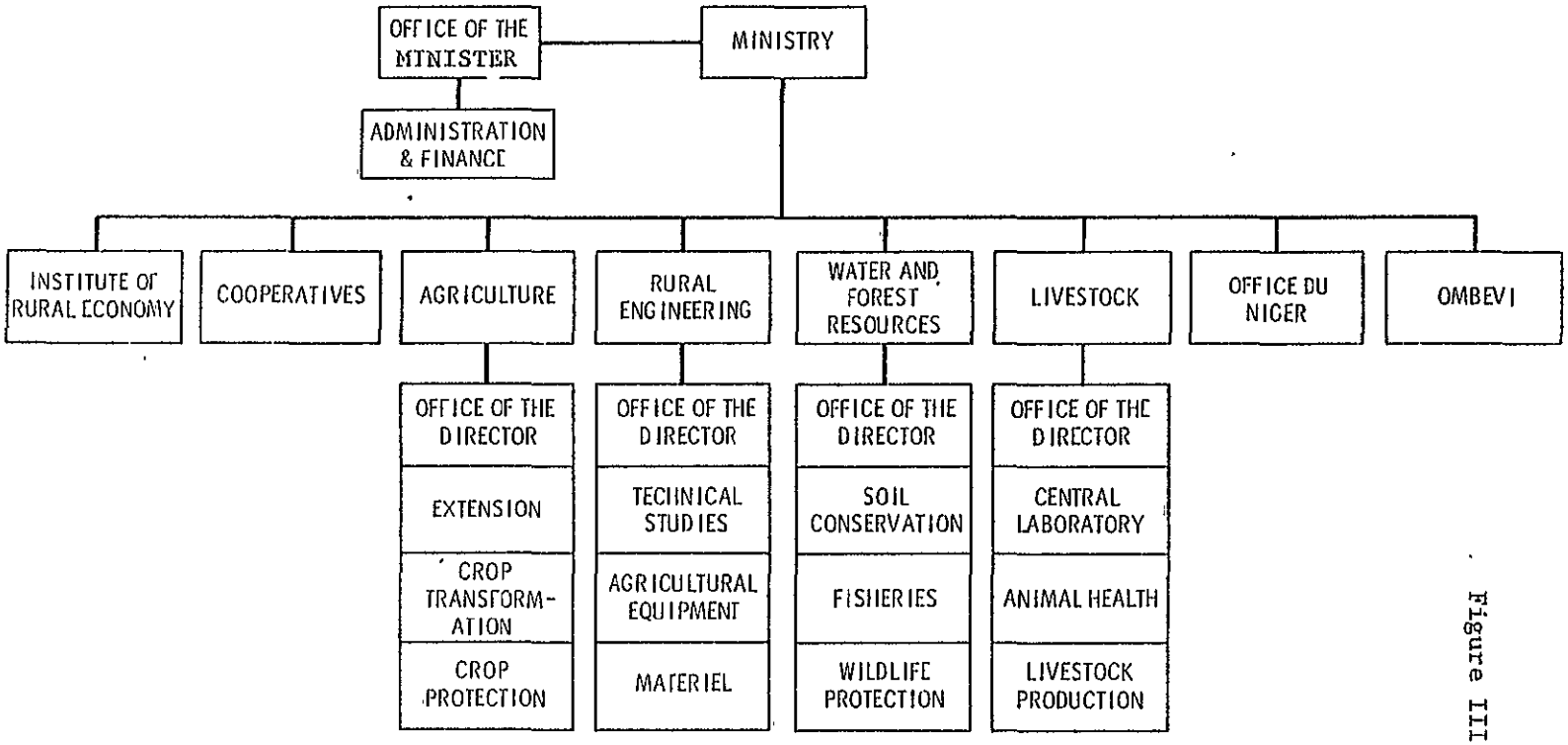
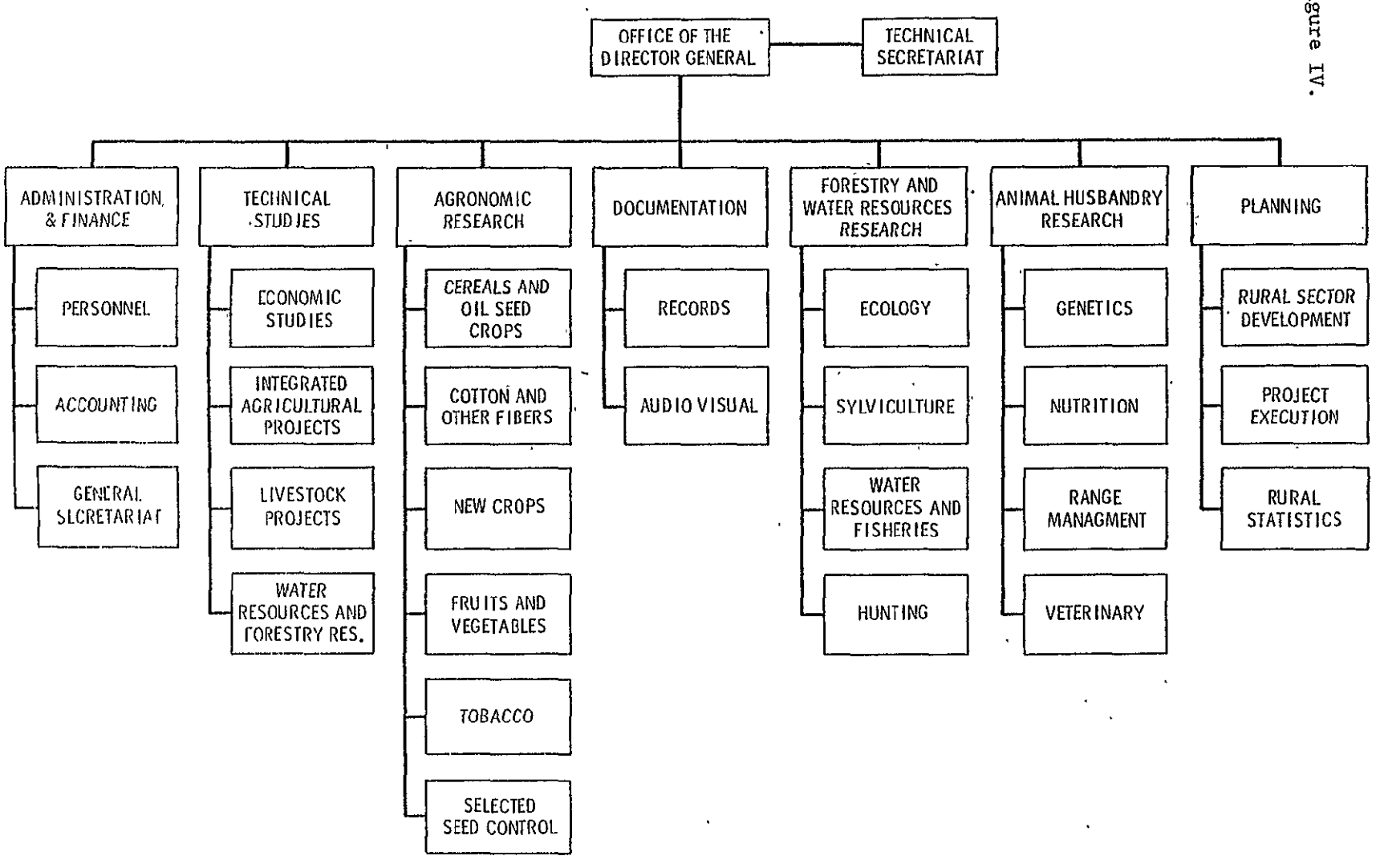


Figure III.

Figure IV.

Institute of Rural Economy



Only a small portion of this staff can devote itself to research; technical studies are done by four senior and five junior professionals in agriculture and livestock.[13] So the scarcities are not in economists alone.

Without a substantial increase in the supply of trained economists, especially agricultural economists, not much growth in policy analysis can be expected. The responsible officials within the Ministry of Rural Development and IER are aware of the need. They have demonstrated their desire to move forward by the creation of the Planning Directorate within IER. Hopefully, technical assistance can be obtained, and with it a carefully thought-out program for training Malian economists, equipping them as quickly as possible with those tools of analysis suitable to the needs of agricultural policy appraisal.

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[13]The IER contracts out for general studies; in recent years, for example, it contracted for studies of the demographic and economic characteristics of the Zone Lacustre; family consumption surveys; a study of the impact of the drought on cattle herds; and several others.

PART III. RECOMMENDATIONS

A. SUGGESTIONS FOR THE MALIAN GOVERNMENT

These recommendations are not intended to be an exhaustive list of things that might be done to improve conditions in the agricultural sector. Instead we have chosen a limited set of recommendations that deserve to be given consideration both by the Malian Government and by external donors. It may well be that a number of them have been at one time, or are now, under study by interested parties.

1. Increased Research Efforts

Recognizing the severe budget limitations faced by the Malian Government, we still believe that a substantial increase in the resources allocated for technical, economic, and social research is warranted. The desire to focus on production programs that can be rapidly implemented is understandable. Yet we would argue that with the current state of knowledge about the sector few agricultural projects can be adequately designed or compared with alternatives. Further, investment in research is generally modest, with a high cost-benefit ratio, and is attractive to many donors.

Among many particular research emphases that are needed we recommend the following for priority consideration by the government and by donors.

(a) Most important is a strengthening of research on production systems. This primarily means cultivation techniques and the use of inputs with substantial attention being given to evaluation of alternative equipment. We note that a similar recommendation was made by the 16th annual session of the National Agronomic Research Committee in April 1976. The research should be performed in various locations with differing "typical" soil, climatic, and economic characteristics. Rigorous farm management analysis should be an integral part of it. To this end, the newly created cultivation techniques section of the Agronomic

Research Division of IER should be funded and given personnel. Technical assistance is probably needed. Results from similar kinds of research in Senegal and Upper Volta can provide useful points of comparison.

(b) Increased emphasis should be given to agronomic research and field testing in the dryer Zones: Sahel, Lacustre, Sixth Region and Séno-Dogon. In these zones incomes of farmers are low relative to those in other zones, as are the levels of technology that have been adopted.

(c) Research into alternatives to traditional crops should be expanded to enable rational land use adjustments as cereals output increases. As the areas and land productivity of the semi-controlled flood areas (Riz Ségou and Riz Mopti) increase, portions of the Office du Niger and other fully-irrigated areas might be converted to crops other than rice. Much of Mali's rice needs can be met at lower cost (though at more risk) in the semi-controlled flood areas, for which there are no feasible alternative uses.

(d) Continuing research to estimate the effects of prices on supply and demand for various agricultural products should be initiated. Supply and demand elasticities and cross-elasticities should be estimated, if better quality time-series data can be obtained from field research. Currently price policy is established and modified without good information about price effects.

(e) There needs to be a new effort to gather and analyse agricultural statistics on a continuing basis. The Enquête Agricole seems now to have so many problems that the best course may be to let it expire and to expand the mandate and funding of IER's Evaluation Unit. One of its main responsibilities would be to carry on micro-economic farm management studies and to conduct sample surveys to establish baseline data for each Zone.

(f) Entomology deserves emphasis. Insects are an increasing problem in Mali as land use intensifies and as more productive, but also more vulnerable, plants are introduced. Entomologists should be available within the country's agronomic research organization.

(g) Support should be provided for on-going research at the Sotuba station into the adaptation of draft animals to Malian conditions. Much remains to be learned about the use in certain zones of donkeys rather than oxen, for example, as well as about efficient ways of nourishing all draft animals.

2. Extension Services

(a) To increase the effectiveness of agricultural personnel by establishing information links between agricultural cadre, an assessment should be made of the availability of all forms of agriculture-related documentation and of the possible creation of a low-cost publication program. In particular, the possible re-publication of the Bulletin de l'Institut d'Economie Rurale should be examined. Furthermore, the program of micro-economic farm management research mentioned above should be geared in part to prepare a low-cost series of professional materials for agricultural extension personnel.

(b) An expansion of Radio Mali rural radio programming should be encouraged and supported. This might involve direct support to Radio Mali enabling the training services within the Operations to prepare more technical broadcasts.

(c) Financial and material support should be provided to improve the training services within most Operations.

3. Production Priorities

We suggest that the government needs to emphasize and give priority to the following aspects of agricultural production.

(a) Dryland farming is more subject to the uncertainties of rainfall than is total irrigation, but it provides Mali with almost all of its millet, sorghum, maize, cotton and peanuts. We believe it would be advisable to concentrate on low-cost methods of increasing the productivity of dryland farming rather than to undertake complex, high-cost irrigation projects. The drought was a tragic, traumatic experience, but it should not lead the government and donors to ignore the costs of allocating resources to large projects whose net benefits may be rather uncertain.

(b) On the other hand, small-scale irrigation projects and supplemental irrigation schemes with clear net benefits should be encouraged.

. . (c) More than any other activity, weeding remains the principal labor bottleneck. Production systems that overcome this constraint and increase yield per man-day are the ones to be sought and extended. It is the productivity of labor that needs to be continually increased.

(d) Measures that preserve moisture in the soil and soil fertility deserve high priority. In the latter category, the spread of legume crops and wider adoption of mixed farming techniques offer particular promise. There should be no illusion that such changes can be introduced rapidly. They have been advocated without notable success for a number of years.[1] While we did find considerable interest in rural fattening schemes among extension personnel, it remains to be determined whether farmers' interest is also growing.[2]

4. Office du Niger

As best we could determine there has never been an attempt to determine and compare the real costs, including social costs, of producing a ton of paddy in the Office with the costs of producing the same amount elsewhere in the country. The WARDA/Stanford FRI study may well provide an answer; if not, one is needed. Even if average yields in the office have now risen to more than 2 T/ha, the infrastructure required to support this level of production remains heavy indeed.[3] As the Office knows, rehabilitation of much of the irrigation and drainage system will be required to preserve what exists and to create potential for exploitation after the Selingué dam is built. If it can be shown that additional investment is desirable, we believe that serious consideration should be given to expansion in areas close

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[1] See William I. Jones' comments on the M'Pessoba formula in Planning and Economic Policy: Socialist Mali and Her Neighbors, p. 270.

[2] In February 1976 OACV undertook experimental feeding of 99 draft animals belonging to 41 farmers of a village in the Banamba sector. They fed 6 kg of peanut greens, 3 kg of cowpea greens, and 1 kg of cottonseed per day to each animal. The animals were tied to posts rather than allowed to roam free. The experiment was considered to have been successful.

[3] As de Wilde phrased the question in 1967, "It is by no means clear how much investment is required to remedy the serious deficiencies in the irrigation and drainage network and whether the benefits would be sufficiently worthwhile in the light of alternative investment opportunities in Mali". op. cit., p. 291.

to Ségou before rehabilitation is undertaken in areas that perhaps should never have been irrigated in the first place. The ultimate goal should be to reduce the dispersion of the scheme by concentrating in those areas that have the greatest economic potential. It may be more economical to expand in a new area than to recreate a workable drainage scheme for an existing part of the system.

5. Crop Conservation, Processing, Storage and Transport

(a) More important perhaps than anything else that might be done to increase production is the need to protect harvests against insect or rodent damage and spoilage. The work of Operation Protection des Semences et Recoltes in extending crop conservation techniques at the farm level should be considerably expanded. In 1975-76 only the CMDT zone was covered. Most preoccupying is the menace of crop destruction by rats in the Zone Sahel and Office du Niger. Officials at Yelimané were extremely concerned about flood-recession corn and sorghum crops that are grown in the off-season and hence are highly vulnerable. In 1975-76 they were badly damaged. This year it will be worse. The sector chief told us that rats would be even more harmful than the drought. In the Office du Niger, officials say that the only thing they can do is to attempt physical elimination. We strongly recommend that action be taken now to provide assistance to Mali for the 1977-78 crop season. We have the strong impression that this is a potentially very serious problem that is not getting adequate attention from donors who could help.

(b) Rapid increases in cotton and rice production in the past two years have taxed processing capacity for both crops beyond their limits. Expansion of capacity is either underway or awaiting funding, but as production also increases, the bottleneck may continue to be felt for a few years. It is not within the scope of this report to make specific recommendations on this point.

(c) Cereals storage is a matter of urgent concern, but before any major program for expansion of central capacity is begun, there should be a comprehensive survey of existing private and public facilities and research into the efficiencies of alternative ways to meet storage needs.

Such research should include: (1) location analysis, (2) analysis of the advantages and disadvantages of sack versus bulk storage, (3) analysis of the economies of size in the Malian context--where on-farm storage is traditionally built with local materials and off-season labor, both of which have low opportunity and no foreign exchange costs--and, finally, (4) a study of the non-economic factors affecting on-farm storage. As a supplement or alternative to expansion of central storage capacity, there should be exploration of improved transportation and marketing facilities and/or price policy changes. The BDPA and IDET-CEGOS studies already mentioned, as well as research on technical storage being conducted in Niger under British/FAO auspices, would provide useful groundwork for further research.

(d) For crops that require transformation, part of the storage problem is due to the slow movement of finished products into domestic or export marketing channels. One bottleneck appears to be SOMIEX's management of exports. For cotton we would support the proposal to give export responsibility to CMDT in order to facilitate the orderly movement of cotton as it is ginned and to alleviate this part of the storage problem.

(e) Transportation bottlenecks are caused both by poor rural roads and poor major highways. With regard to the former, labor-intensive construction and maintenance of feeder roads and trails during the dry season may provide a solution. However, in general, financing would have to be such that payments could be made in cash as well as in kind. Subsistence farmers usually want more food only if they have a current shortage or if a good market exists for commodities given under a food-for-work program.

(f) Another source of the transportation problem is the low ton/kilometer haulage rates allowed by law. A widespread need to commandeer private trucks for transporting agricultural products clearly indicates that trucking rates are too low. A large part of the transport problem might be solved by increasing freight rates to allow private truckers to cover real costs, including labor and entrepreneurship costs.

6. Marketing

The primary attention of the government and of donors has been focused on increasing agricultural production of cereals and export crops. This orientation has been justified by a need to replace cereal imports with domestic production and by a need for foreign exchange revenues. Now, however, the production capability or potential has developed to a point where markets and marketing facilities are limiting output and income expansion in the sector. Unless substantially more attention is given to the need for attractive markets and facilities adequate for commodity movements, there may soon be strong disincentives to production. We think that in most areas the farmers now have adequate resources and knowledge to produce major increases in agricultural output. We recommend that Government turn its attention to assuring markets that will provide incentives.

One very positive step that could soon be taken would be to begin the marketing campaign earlier, perhaps at the beginning of October, in order (a) to take advantage of the availability of cereals that are now purchased by private traders and (b) to be in a position to move cereals down the Niger River to Gao while it is still navigable.

7. Price Policy

Some observers have maintained that in the mid-sixties the Malian farmer was given considerable exhortation but little material inducement to produce more and market more. The result was a turn back toward subsistence farming and increased auto-consumption, particularly of peanuts. No doubt the lack of consumer goods in rural areas played an important part, but the stagnation of producer prices was also crucial. The lesson of the early years was that inducements are indeed important, and that price policy matters a great deal.[4]

We fully recognize the delicacy of the issue and are aware of the debates that swirl around it. Nonetheless, we believe that in the case for increasing official producer prices has been made in this report, particularly in II(B). The case is strongest for cash crops, notably cotton and peanuts, since it is with profits from these crops that farmers will be able to invest in the modernization

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[4]For example, see W. I. Jones, op. cit., pp. 299-305.

of their own techniques. With regard to cereals, we believe that price policy should be flexible enough to allow relatively high official prices in poor years and relatively low prices in good years. The former would, we suggest, tend to call forth a greater quantity of farmer's reserves for distribution to deficit zones, while the latter would ease the burden on government storage and transport operations.

We have suggested in 1(d) above that there is need to do research on price effects to assist the government in making its policy decisions. In addition, the government's capacity for analyzing policy proposals should be greatly strengthened. The IER Evaluation Unit's study of production costs in June 1976 was the only example we were able to find of an attempt to do a rigorous analysis of the implications of policy alternatives. As a first priority, immediate attention should be given to training a core of policy analysts, especially economists.

8. Labor-Intensive Projects

Large-scale construction works may not be appropriate projects for the use of labor-intensive techniques since hand compaction is often not sufficient, the works take a long time, and there is usually a conflict with the agricultural calendar. There are, however, a number of small-scale projects which can be done labor intensively, which are not particularly expensive, and which offer possibilities for the utilization of untapped local labor and materials. Included are the following: (a) construction of secondary and tertiary irrigation and drainage canals; (b) construction of small dikes: (c) reforestation; and (d) construction of buildings (schools, storage structures, low cost housing etc.).

US/AID has financed in cash and in kind several labor-intensive projects in reforestation, erosion control, dike construction and road rehabilitation. The Malian Government has identified a number of other projects aimed at increasing employment in rural areas.[5] What is holding back this program is not lack of planning or of manpower but of sources of funding. We would recommend that other donors follow US/AID's lead in this domain.

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[5]See Bakary Traoré, "Programme de Travaux à Haute Intensité de Main d'Oeuvre dans le Secteur Rural." Ministère du Developpement Rural, IER, Cellule de Planification, February, 1976.

B. RECOMMENDATIONS FOR US/AID

1. Support for Malian Initiatives

A number of the suggestions we have made above may be appropriate for support by US/AID. The possibilities include:

(a) research on production systems;

(b) help in expanding the capacity of the IER Evaluation Unit to undertake basic research on price effects, to carry out farm managements studies, and to establish baseline data sets;

(c) technical assistance in entomology;

(d) support for the re-training of extension agents;[6]

(e) material and/or technical support for a campaign against rodents prior to the 1977-78 crop year; and

(f) a survey of existing storage facilities and research into the efficiencies of alternative ways to meet storage needs.

2. Projects to be Explored

(a) The embryo Operation Vallée du Sénégal-Térékollé-Magui (OVSTM) deserves consideration for support. The terms of reference of the German study of that zone specifically state that a certain number of small projects should be studied and if possible undertaken before the completion of the overall analysis. As we have indicated in section I(G), help for local groups who are attempting with rudimentary methods to control the flooding of seasonal streams should be a priority consideration. Material help for OVSTM along the lines of what was provided to Operation Mil Mopti should also be considered, if local currency sales proceeds are still available.

(b) The possibility of small irrigation projects elsewhere in the North also warrants study. Farmers could successfully use small pumping systems and not be fully dependent on residual soil moisture.

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[6] More than one official mentioned to us the need for retraining. Perhaps former Peace Corps Volunteers who have worked in agricultural programs in French-speaking Africa could be recuited to organize a retraining program within a particular Operation. If US/AID decides to fund the Haute Vallée project, this might be a good place to start.

For example, irrigated wheat production on the Diré plain, a project under consideration by US/AID, holds interesting potential. Research results from IRAT as well as OMVS studies in the nearby Senegal River basin show that yields of 3.5 tons per hectare are possible when wheat is grown under irrigation during the cool season. Early maturing spring wheats or durum wheats could be planted in mid-November and harvested in March. We support consideration of the Diré project as being consistent with helping to make the cereals-deficit areas more self-sufficient and/or providing the population in these areas with a means of earning higher incomes. The technical and economic feasibility of such a project is, of course, another matter.

(c) In the office in Niger, if the WARDA/Stanford and other studies demonstrate the desirability of further investment, US/AID should draw on American irrigation expertise to help the Malian Government determine the best way to rehabilitate the existing irrigation and drainage system. A team should include the following: senior irrigation or water resource engineers; a management consultant well versed in the management of irrigation systems; a specialist (engineer) in the operation and maintenance of irrigation systems; an agricultural economist; and an agronomist.

Given the serious problems faced by the Office (discussed in Appendix B) and the clear need to examine both the economic and technical feasibility of general rehabilitation, we suggest that for the present time US/AID limit itself to consideration of one specific project within the Office. We refer to the possibility of financing the conversion of 1,000 ha of existing land in the Kala Inferieur section to the production of forage crops. The project is included in the 1974-78 Plan, but few details are given. We believe that it merits exploration for several reasons:

(1) the Malian Government's strong interest in the development of forage crops in different regions of the country as a prelude to livestock production in later periods;

(2) US/AID's present involvement in the livestock sector;

(3) the Office's need to make greater use of its animal traction potential if it is to master the weed problem and come closer to attaining yield potentials:

(4) the apparently limited nature of the involvement that would be required (though this needs to be verified); and

(5) the possibility of experimenting with irrigation associations to provide for farmer participation.[7]

It may well be, however, that the Office intends to use direct farming for the forage crop project. If this be the case, it would eliminate the possiblity of farmer participation and probably make the project less appealing.

4. Keniéba Crop Production Project

This proposed project falls within the OACV zone, which was extended to cover the entire Cercle of Keniéba in 1974-75. While OACV efforts are just beginning in the area and while it is clear that the Cercle lags behind its neighbors in the amount of agricultural progress it has made, we believe it would be more appropriate to leave crop production projects of all kinds to OACV. (See section I(F) for our conception of the way in which the development Operations are evolving.) In that part of Mali, needs are more pressing in the Sahelian Zone north of Kayes where there is no functioning Operation.

[7] A highly desirable step after an irrigation system is in operation is to involve the beneficiaries in the management and operation of that system. This can be done through the formation of irrigation associations. The irrigation association, if well organized and planned, can allow each beneficiary to participate in the operation and management of the irrigation system.

TRADITIONAL APPROACHES TO PRODUCTION: AGE GROUPS, THE EXTENDED FAMILY, AND LAND DISTRIBUTION UNDER SCARCITY

Age Groups

Probably the most well known and visible manifestation of the fundamental egalitarian reality binding families and communities together is the ton, or the elaborated coalition of age-sets that exists in each village. All male inhabitants of the village must join their appropriate age-set, based on different initiations (e.g., circumcision).[1] Membership in the ton cuts across family and caste lines, and makes very clear what the relative ages are within the village and the family.

Each ton is well organized and highly hierarchical. The head of each ton (ton kontigi) used to be formally chosen by the village council but is now elected from the oldest age-set by the member of the ton; the ton kontigi is assisted by numerous organizers. The ton by definition signifies discipline and order. Serious misbehavior (e.g. refusal to participate in collective work when demanded or insulting the head of the ton) is sanctioned by exclusion from the ton or a heavy fine of kola nuts. Minor misbehavior (being late to meetings, not paying attention, lack of ardor in fieldwork or festivals) is sanctioned by small fines.

Traditionally the age-sets functioned as a reserve pool of agricultural manpower, coming to the aid of families lacking manpower. They also served, in former times, as organized units for village defense.

Some of the services provided by the ton consist of salaried labor solicited by members of the village; there are, however, numerous collective tasks performed -- many of which are directly solicited by the village council: guarding against (and fighting) brush fires, weeding and upkeep of public places, market "policing",

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[1] Age group patterns exist among women also, but they are not as hierarchical and well-organized. The female ton are usually associated with and directed by the male ton.

and repair of public buildings. In some villages the tons have provided other services such as news diffusion, guarding of mango trees, or construction of village schools.

In the 1960's the direct intervention of the national political party and the local administration in some areas brought into being certain tons (Mali-ton) that would work in conjunction with local functionaires on many of the same tasks as the traditional tons, but with the goal of generating national identity and pride. Some of these Mali ton farmed collective fields made available by the villages.

It should once again be emphasized that the capital accumulated by the ton during a farming season of hiring itself out cannot be spent, by definition, on capital equipment or other finite forms of improvement, such as cement-lined wells. If it were, certain compounds (du) would accrue disproportionate benefit from these investments -- e.g. proximity to a well or access to a special plow at a more advantageous moment. If ton earnings were put to such uses the compounds which got secondary access to the capital goods would cease to release their laborers to the ton on the designated days of the week and refuse to pay the kola nut fines such truancy would incur. The discipline and order for which the ton is named would disintegrate.

A week-long festival represents a less controversial way of distributing such earnings: all villagers are fed by the ton during this period, no one loses face by being given an unequal share in the ton's benefits, and the excitement of the festival is often sufficient to keep some youths from making their habitual dry season visit to the Ivory Coast.

Production of the Extended Family

The product of work done in common by the extended family (average 9.6 persons in 1972)[2] is called the foroba. The head of

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[2] Rapport de l'Enquête Agricole 1972-73, p. 14.

the extended family (the oldest in the lineage) is the administrator (the fa).

(a) The foroba of the extended family consists of:

- the harvest of the family fields and any money coming from the marketing of the harvest;
- the agricultural equipment of the family fields (plows, oxen, etc.);
- any firearms;
- any animals slain by these firearms;
- any bride price received (primarily cattle);[3]
- the income of any family members from marketing or handicrafts;
- bicycles and other equipment brought back by the young after having worked abroad (although the head of the extended family may let the acquirer use the equipment);
- any clothes, cloth, or jewelry acquired by the head of the extended family with the proceeds of the collective fields;
- any ancestral relics.

(b) The foroba is used for the following purposes:

- feeding members of the extended family;
- payment of taxes;
- payment of bride price;
- investments (cattle, agricultural material, gold, etc.);
- financing of all celebrations, circumcision ceremonies, marriages, funerals;
- payment of certain individual needs (for example, travel expenses for a family member going to work abroad.)

Land Tenure in the Sixth Region

Land is scarce in the Sixth Region, since the only cultivable areas are those inundated by the Niger. Accordingly, a land tenure situation very different from that of the rest of Mali has come into being.

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[3] See Emile Leynaud, Les Cadres Sociaux de la Vie Rurale dans la Haute Vallée du Niger, Etude Sociologique, Vol. II. BDPA, 1961.

Five different categories of land and land potential can be distinguished:

(1) plots that are relatively sure to produce, regardless of rain or flood variation;
(2) very low land which can be cultivated in those years when the flood rises slowly and evenly;
(3) middle plots that are always inundated but whose yields fluctuate depending on the amount of time between the rains and the flood;
(4) higher land that is not always inundated but is suitable for flood-recession sorghum; and
(5) dune land of very low productivity.

According to the location of a farmer's plots, one can crudely estimate the security with which each family can provide for its needs. Land is worked by families, the most influential families of the villages possessing the best plots. The beit-et, or collective fields, are disappearing in the context of scarcity and individualization of the land.

Land is often exchanged between families with the goal of trying to have a complete and sure spectrum of agricultural possibilities. Systems of land tenancy, land rent, and salaried labor have also developed in the Region.

The mean holding is characterized by:

- a surface area of 1.36 ha (compared with 4.23 ha for the rest of Mali), of which:

.66 ha rice
.35 ha sorghum
.12 ha rice and sorghum mixed
.21 ha millet
.02 ha cowpeas (intercropped with millet and sorghum).

This area feeds 7.1 people and is worked by an average of 1.6 active

males and 1.5 active females. The area is divided into a mean of 1.8 plots, each with three-quarters of one hectare.[4]

The mean hides a wide range of holdings. Fifty-four percent of the farm units cover only 18 percent of the total cultivated area, while at the other end of the scale 11 percent have 32 percent of the total surface. Some farm units exceed 15 hectares. These plots are often worked by hired labor, paid in cash or in kind.

The significance of such a distribution is that it is really only the minority of the farm families (43 percent) that are able to balance the risks and variations found in different kinds of land. The majority (52 percent) must rely on a single plot and hence is extremely vulnerable to fluctuation in rainfall and flood. The remaining 5 percent is landless.

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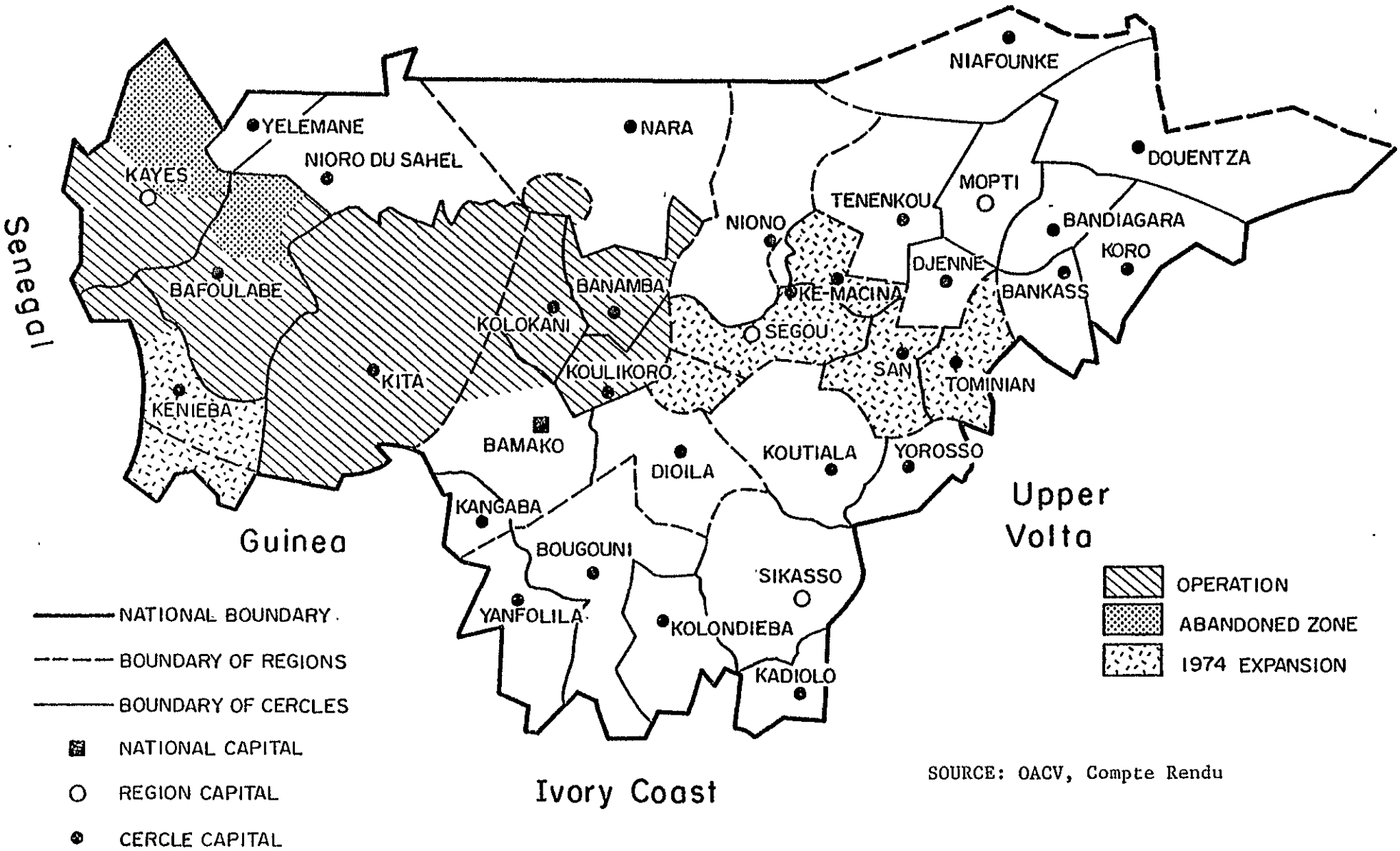
[4]See SATEC, Etude de Reconnaissance de la Vallée du Niger dans la Région de Gao, Vol. III, Paris, April 1975.

MAP 6. Opération Arachide et Cultures Vivrières, 1974-75



SOURCE: OACV, Compte Rendu

Appendix B

I. OPERATION ARACHIDE ET CULTURES VIVRIERES

Background

OACV was expanded in 1974 and now stretches for 850 kilometers across the upper belt of arable Mali, from the Senegal/Guinea border to that with Upper Volta (see Map 6). Within its zone there are about 100,000 farm units and 20 percent of the Malian population.

The Operation was created in 1967, the year after the amount of peanuts marketed in Mali had slumped to a disastrous level. Operation Arachide (as it then was called) focused initially on developing the production and marketing of peanuts in a limited area of five Cercles which were considered to be the most promising.[1] The French agricultural extension agency BDPA provided technical help, and France financed the Operation with a total of 1.6 billion MF in its first five years.

By the 1969/70 agricultural year the Operation had expanded to about two-thirds its present size. In 1974 it was transformed into OACV, adding an emphasis on cereals as well as activities in the fields of functional literacy, human and animal health, road construction, research, and evaluation. The World Bank became the primary external donor at that time.

The peanut production and marketing figures for the two years since the end of the drought demonstrate the overall effectiveness of the Operation. In 1974-75 the OACV zone produced 110,300 T of peanuts (shelled weight), with an average yield of 1,028 kg/ha, and marketed 60,120 T. When OACV's figures are added to those for peanuts grown outside of the zone -- where the average yield is estimated to be only 500 kg/ha -- the Operation is seen to have accounted for 59 percent of Mali's peanut production and 86 percent of the amount marketed. In 1975-76, although official figures had not yet been published, it is apparent that the country reached a record level in production and marketed the second-highest total in history.[2]

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[1] The Cercles were: Bamako, Banamba, Kita, Kolokani and Koulikoro. République du Mali, Ministère de la Production, Institut d'Economie Rurale, Rapport de Factibilité de l'Operation Arachide - Culture Vivrières, Jan. 1973, Vol. I, p. 33.

[2] The marketing record is 97,000 T established in 1957-58. With OACV marketing 78,200 T by itself in 1975-76, the country-wide total of 89,000 T exceeded the second-highest amount previously recorded: 85,700 T in 1960-61.

Peanut Production

To encourage peanut production, OACV has undertaken the extension of two sets of improvements: one for "productivity" and one for "modernization". The former are for wide distribution; the latter are limited to a small number of innovative farmers who are also able to purchase animals and equipment for animal traction. The use of selected seed and fungicide, early sowing, greater density and proper weeding are the productivity themes. Fertilizer may be used as well. The modernization themes are: a more rational exploitation of the farm unit, the use of fertilizer and animal traction, and the integration of livestock and crop production. A survey by the Rural Economy Institute's Evaluation Unit (Table i) inidicates the extent to which these themes have been adopted.

What is interesting about Table i is that the percentage of farm units equipped with multiculteurs, plows and ox-carts is higher -- dramatically higher in some sectors -- than might have been suspected. This is particularly true of plows and 500 kg ox-carts. It should be noted, however, that until 1974 the Ségou, San and Tominian sectors were covered by Operation Coton, where plows rather than OACV's multiculteurs are recommended.

It would thus appear that the picture of the rural sector in at least the OACV zone is more complex than a division of it into a small number of equipped, innovative farmers and a large mass of traditional farmers who are rapidly learning to follow the productivity themes. A village study in the area southwest of Kita by Abdoulaye Sango[3] divided farmers in that locality into four groups:

(1) a small number of innovative, equipped farmers (paysans de pointe);
(2) a group of equipped farmers who had fallen back on certain traditional practices (dégénérés);
(3) a group of unequipped, average farmers who use some fertilizer; and
(4) a group of traditional farmers who do not.

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[3]Abdoulaye Sanogo, Memoire de fin d'Etudes: Evolution de l'Agriculture dans les zones de l'O.A.C.V.: Etude Comparative d'une Exploitation de Pointe d'une Exploitation en Système Traditionnel. Katibougou, Institut Polytechnique Rural, 1975.

TABLE 1. Percentage of OACV Farm Units Using Extension Themes

Sector	Modernization Themes					Productivity Themes				
	Multi-culteur	Plow	Seeder	Ox-Cart 500	Ox-Cart 1,000	Selected Seed	Manure	Chemical Fertilizer	Fungicide	Insecticide (Granary)
Koulikoro	14	32	4	22	7	42	49	20	53	22
Banamba	26	36	10	53	4	58	79	35	60	24
Kolokani	7	9	6	9	1	52	34	56	56	20
Kita	10	8	9	13	2	46	18	48	42	21
Kayes	3	14	1	1	2	19	39	15	33	18
Bafoulabé	6	27	9	9	--	65	18	71	62	9
Keniéba	--	--	--	--	--	9	5	7	2	--
Ségou	6	66	2	21	18	50	63	19	28	12
San	7	65	--	4	7	30	50	15	20	11
Tominian	2	63	2	7	14	50	36	33	34	7

SOURCE: Rural Economy Institute (IER) Evaluation Unit working papers based on preliminary survey using a sample of 1,000 farm units in 140 villages, 1976.

The phenomenon of advancing to a certain stage of "modernization" and then returning to practices not recommended by extension agents is an intriguing one. Sanogo cites the following as examples of "degenerate" practices:

(a) failure to cross-harrow in the belief that it is wasted labor at a time when labor is a constraint. This permits cropping a larger surface;

(b) using equipment on land that has not been de-rooted; and

(c) using a seeder without tracer in the belief (1) that only beginners who have no "eye" need it and (2) that it gets hung up on roots.[4]

We found at least one sector chief who lamented that farmers were falling back on traditional methods, including pilot farmers who had not been visited regularly by agents. The sector chief ascribed the phenomenon to a lack of agents and felt that there needed to be renewed emphasis on the productivity themes. It is quite possible, of course, that from the farmer's point of view it is correct for him to return to traditional practices. While the Operation is concerned about yield per hectare, the farmer may be more interested in improving yield per worker per year, provided land is not a limiting factor in his case.

What is the situation with regard to agents? The Operation has reported that in May 1975 it had the following field personnel:[5]

7	sector chiefs
23	sub-sector chiefs
305	agents in charge of secteurs de base (8-10 village
13	animal traction agents
348	

For the entire zone, these agents need to cover some 109,000 ha producing peanuts and 252,000 ha producing cereals. This works out to an average of about 1,200 ha per agent, not including the sector and sub-sector chiefs. In some sectors agents are required to cover considerably more territory. The

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[4] Ibid., p. 21.

[5] OACV, Compte Rendu de la Campagne Agricole, 1974-75. Bamako, December 1975, p. 22.

Kita sector chief, for example, estimates that his men average almost 2,000 ha each. Considering that holdings are small and that each secteur de base covers 250-300 farm units, it is not surprising that coverage is thin. The IER Evaluation Unit's survey shows that in half the sectors more than 50 percent of the farmers see extension agents less than four times a year, sometimes never. We discuss in section II (F), page 175, the tendency of agents, when obliged to cover too much territory and when responding to production incentives, to concentrate on the well-equipped, innovative farmer. To the extent that this is true of the OACV zone, it is further evidence that benefits (subsidies, credit, extension services) may go to farmers who are comparatively well off while being paid for (through deductions from the price they would otherwise get) by more traditional farmers.

Price Policies

Even if the paysans de pointe tend to have benefits at the expense of the traditional peanut farmer, the former are still facing rising costs and a stationary price for their product. Several OACV officials told us that price policies have become the major constraint to further progress in the OACV zone. The success of the modernization themes is directly linked to prices. As the OACV annual report phrased it, "The organization's future is intimately tied to the problem of providing production incentives through the payment of remunerative prices to producers."[6]

Farmers in the Kita sector, which produces 45 percent of the peanuts marketed in the whole OACV zone, were disappointed in 1975-76 when they were led to plant more peanuts than normal on the expectation of a rise in price. The increase of the producer's price in Senegal to more than twice the Malian price (the equivalent of 83 MF as opposed to 40 MF) and increases in input prices announced in May 1975 all combined to create the expectation. But the price was not raised; nor was it raised for 1976-77.

The effects will undoubtedly be registered in 1976-77. There were in fact indications in June 1976 that peanut farmers were taking less fertilizer and seed than they did the previous year. While it is probable that

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[6]OACV, Op. cit., p. 86

certain factors will contribute to higher production and marketing levels as long as rainfall is adequate,[7] the serious labor-for-weeding bottleneck is certain to be made more severe by stagnant prices. Many peanut farmers seem to have a tendency to plant more acreage than they can weed, obliging them to rely on outside labor. The IER Evaluation Unit's survey shows that 27 percent of the farm units in the Kita and Keniéba sectors and 15 percent in the Baloulabé sector use outside labor in the weeding phase. This can be hired but is usually provided either by cooperative groups or by navétane tenant farmers.

To take only the case of navétanes, higher relative prices in Senegal and the Gambia have drawn numbers of them out of Mali for the 1976-77 crop year. As a result, OACV agents in the Kayes and Kita sectors are expecting a real labor pinch. In the Sadiola subsector, for example, there was a net inflow of 230 navétanes in 1975-76, largely from the Keniéba Cercle. This year OACV agents are expecting only 100 from Keniéba while losing more than 300 to Senegal, net out-migration of over 200. The change between 1975/76 and 1976/77 is thus a loss of over 430 navétanes, which should have definite effects on peanut production.

Cereals Production

Having expanded its focus to cover cereals as well as peanuts, OACV is seeking ways to put the new emphasis into effect. It distributes a small amount of selected millet, sorghum and corn seed without charge. Because of the villager's sensitivity to taste, color and other qualities, the amounts are kept purposefully small.[9] The Operation has some difficulty, however

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[7] Inhabitants of the Keniéba sector, for example, are said to be relying more on cash crops for earnings and less on panning for gold in the dry season.

[8] Navétanes are principally found in the Bafoulabé and Kita sectors. They move into the major peanut-producing areas to work on plots provided by "logeur The logeur feeds and gives shelter to his navétanes; he also enables them to obtain selected seed and fertilizer by guaranteeing repayment to the OACV extension agent. In return, the navétane works two days a week in the fields of the logeur and may work a couple of hours in the late afternoon as well.

[9] For example, the Kita sector distributed 20 T of selected millet seed and 3 T of sorghum in 1975. Half of the millet seed was of the Souna variety. It turned out that (a) it was distributed late and hence planted far from habitations, as a result of which the seed was heavily eaten by birds, and (b) the taste was not what the villagers wanted. Kita is not distributing any more Souna.

in determining how the selected varieties have done since there is so much trading of small quantities of seed among farmers.

OACV also recommends a rotation of peanuts/cereals/peanuts/cereals/ fallow so that the cereals will benefit from the residual effects of fertilizer as well as the nitrogen-fixing properties of peanuts. The value of using chemical fertilizer directly on millet and sorghum is questioned by OACV.[10]

The operation has decided to concentrate its cereals effort on maize production. When compared to millet and sorghum, the constraints to increased maize production heretofore have been the following.

(1) It is more susceptible to weed infestation and therefore requires more weeding.

(2) It is less resistant during dry periods.

(3) Harvesting is more difficult.

(4) Milling is more time-consuming if done by hand and more costly if by machine.

In the past most maize production has been on very small plots in the immediate vicinity of village houses.

The Operation will now work with paysans de pointe who are in a position to follow the proper animal traction techniques on relatively large, pure stands. Two varieties of selected seed are to be used (Kogoni B for lower rainfall areas and Zamblara for higher). Fertilizer for maize will be sold on credit while those who want it for millet or sorghum will be obliged to pay cash. OACV's idea is that maize is quite responsive to fertilizer and can be made less susceptible to drought when sown in line and weeded with animal traction. OACV then hopes to remove the milling constraint by installing a few motor-driven mills made by SISCOMA in Senegal. They will be provided to village women's groups on credit.

The overall pricture of cereals production in the OACV zone is quite good. It is worth remembering that the Operation covers an intermediate

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[10] OACV, op. cit., p. 32. Roger Montgomery concluded, however, that at 1975 prices a "light dose" of fertilizer (100 kg/ha of ammonium phosphate or cotton mixture plus 50 kg/ha of urea) resulted in "an appreciable improvement in per hectare output and net revenue" when used on both sorghum and millet in Mali. Op. cit., pp. 54-63. See also section I(K) 3, page 98.

area, to the south of which is found the high-rainfall, highly productive Zone Sud, and to the north of which are the cereals-deficit areas of the Sahelian Zone. In 1974-75 the OACV zone was estimated to have produced 157,000 T of cereals, creating a slight surplus. The sectors with the highest surplus were Kita, Kolokani and Bafoulabé. By the end of that first year after the drought OACV was already concerned about overproduction. The Operation found that farmers' cereal stocks were being rapidly built up to traditional levels and that those who wished to sell an excess between November 1974 and August 1975 were faced with a free-market price of only 20-25 MF.[11] The risk of overproduction for available markets did not diminish with the 1975-76 harvest which OACV unofficially estimates produced 213,000 T of millet and sorghum and 11,000 T of maize in the zone.

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[11] OACV, op. cit., pp. 82-83.

Appendix B

II. OPERATION HAUTE VALLEE

From the point of view of agricultural potential, the upper valley of the Niger River is one of the most promising areas of Mali. It shares many of the favorable agricultural attributes of the Zone Sud (from 1,000 to 1,300 mm of rain) and also has the added benefits of the river (transport and irrigation) and proximity to Bamako. These characteristics suggest conditions favorable to agricultural intensification and diversification.

Background

In 1959 a complete study of the area was undertaken by France's Bureau pour le Développement de la Production Agricole (BDPA). Later France agreed to support a program which would provide extension services and create an integrated rural development program in the Haute Vallée. In July 1965 the first activities financed by the Fonds d'Aide et de Coopération (FAC) were undertaken. The program consisted of general management and the financing of complementary studies on production and marketing.

In 1968 "Action Tabac" was financed by the European Development Fund (FED). At that time there were high hopes that tobacco would not only fulfill the needs of SONATAM (the government tobacco company), but also that an export market could be promoted and developed. It is interesting to note that Operation Haute Vallée (OHV) started as an integrated rural development program (with programs in livestock raising, feeder road maintenance, forestry and water resources) and became progressively transformed into a more specialized Operation, concentrating first on cotton, then peanuts, then tobacco. It was felt that the integrated approach was not efficient enough, demanding large investments which financing organizations hesitated to commit.

Focus of Program

The primary objectives of the present Operation (in accordance with national priorities) are to increase cereal production, particularly rice, through water control and management. There are also plans for the intensification of cotton and peanut production, drawing on techniques developed in Zone Sud

and Zone Ouest. Production of millet, sorghum, and maize is also to be expanded.

The intensification of vegetable production in the area holds considerable promise, given the needs and proximity of Bamako. Potato production is envisaged; green peppers are already being exported to Europe, and the export possibilities of other vegetables (e.g. eggplant) are also being explored. The development of tobacco has been considerably set back, however, as a result of technical problems and lack of an export market.

The Operation, to fulfill its objectives, plans to increase substantially the amount of farm equipment in the region, particularly equipment for animal traction. This is to be made possible through the availability of medium-term credits. Expansion of extension personnel is also a priority objective.

It is also projected in the 1974-78 Plan that 500 functional literacy centers will be opened in the Operation (with the objective of training 12,500 producers). As of June 1976 this program was not yet underway.

Major production constraints in the Operation are the inadequate feeder road network, rendering large areas inaccessible to transportation and other services during the rainy season; and the lack of sufficient rice milling capacity, requiring the shipment of paddy out of the region for processing (generally to the Office du Niger).

At the end of the Plan, the operation is projected to have a total of 79,000 cultivated hectares, of which 7,300 are to be irrigated. As a result of financing difficulties, this development, which holds considerable potentia is well behind schedule.

US/AID has approved a Project Identification Document requesting a grant of $10,452,000 to promote integrated development of the Haute Vallée zone. The proposed project would inter alia:

a) rehabilitate 7 polders,
b) construct 10 minor irrigation schemes for rice,
c) improve 280 km of feeder roads,
d) construct 60 wells, 4 schools and 2 dispensaries, and
e) strengthen OHV extension services and training

Tobacco Growing and Marketing

Some members of the mission had the opportunity to spend approximately three days in the Operation Haute Vallée zone, particularly in the area around Kangaba. This is not enough time to understand fully the workings of the Operation and problems that it may face. We have no pretentions of having been able to do so. What we do attempt to address in this brief section are the human aspects of the problems that we observed as being associated with tobacco growing and marketing.

Introduced in 1969, the cultivation of tobacco raised hopes not only of fulfilling internal demand and of becoming the area's main export crop. Farmers also saw the possibility of having their incomes substantially increased. This was especially appealing in light of the fact that tobacco is cultivated during the dry season when labor demand is low.

The following Table records the fall in tobacco production that occurred starting in 1972 due to a number of converging problems, among which was was the fact that export markets never materialized and the Operation was plagued by marketing difficulties.

Table ii. Tobacco Production, Operation Haute Vallée

	69-70	70-71	71-72	72-73	73-74	74-75
Area Planted to Tobacco (ha)	17	102	200	383.5	160	102
Production in Metric Tons	25	145	410	533.4	300	119.9

SOURCE: Operation Haute Vallée

Mode of Production

Tobacco is grown in the context of the extended family. It is a crop that is very labor-intensive, needing approximately 620 man days of labor per hectare, half of which is for tieing and drying. Given the high level of inputs demanded, several families often join together to be able to cover the costs of the necessary equipment (especially the motorpumps).

Tobacco cultivation also demands large quantities of fertilizer: approximately 300 kg urea, 500 kg ammonium phosphate, and 400 kg of potassium sulfate. Because tobacco is a dry-season crop, it must be planted either near the river or another water source; often cultivation is only possible through the use of motorpumps. The price of a pump, as well as of other inputs, has substantially risen in the last few years. At the same time there was a decrease in the producer price of tobacco.

Table iii. Producer's Prices for Tobacco, 1974-75 and 1975-76

Quality of tobacco	Price paid to producers 1974-75	Price paid to producers 1975-76
1st choice	400 MF/kg.	300 MF/kg.
2nd choice	350 MF/kg.	250 MF/kg.
3rd choice	250 MF/kg.	150 MF/kg.

Because of this fall in prices, certain farmers found themselves in the position of having nothing left after paying back their input loans. One farmer, who did not have access to a motorpump, marketed a small quantity of low-quality tobacco and ended up owing money to the operation to pay the cost of his inputs.

Tobacco Marketing

The officials of OHV recognize that the most serious problem confronting tobacco is marketing. The state tobacco company (SONATAM) has the monopoly on tobacco marketing and distribution; it is SONATAM that provides the funds and the sacks necessary for marketing tobacco. During the buying phase the company makes available to the Operation 20 million Malian francs a week. These funds, however, ensure only about four days of buying, at which time the Operation must make an accounting to SONATAM -- a process that often takes up to 15 days. This means that the buying of tobacco is subject to interruptions that last up to 15 days; this was something that farmers indicated they had a great deal of difficulty understanding.

The tobacco was also marketed as much as six months behind schedule. At the moment when the farmers have the most need of money (to pay taxes, buy cloth, and participate in annual celebrations and festivals), the revenue from the tobacco harvest was not forthcoming.

The drying and curing of tobacco also gave rise to a number of difficulties. OHV does not have a large number of "sechoirs" at its disposal; there are hardly any storehouses. Because of the lack of storage facilities, it was necessary to store the tobacco either in the sechoirs or in farmers' courtyards. When the marketing is very late and does not occur before the first rains (as was the case during our visit), tobacco losses increase.

One farmer had his tobacco rejected two years in succession because of its low quality. (The tobacco is grouped into three classes, depending on the length of the leaf, coloring, insect damage, etc.) He was nevertheless obliged to reimburse the cost of his inputs.

One other problem worthy of note is the lack of tobacco sacks and the late arrival of those that were available. This type of problem, seemingly small, constituted one further interruption in the orderly marketing of the crop.

All of the above factors (fall in the producer price, increase in the price of inputs, marketing problems) are such that there is discouragement and some apparent bitterness among the tobacco farmers. Unless things change quickly, a number of farmers informed us, they are going to discontinue tobacco growing, and return to food crops (potatoes for instance). In case there are marketing problems, they indicated, potatoes can at least be eaten, rather than left to rot.

III. THE OFFICE DU NIGER

The intriguing history of the Office du Niger irrigation project goes back to 1925. There is no need to repeat here much of the narrative found in a chapter in the de Wilde case studies (1967) and in the WARDA Identification Report (1974).[1] Given the vastness of the original conception (960,000 ha of rice and cotton), the amount of investment that has been poured into it, and the authority of its administration (sometimes called a state within a state), one can only comment that the Office is in a class by itself.

De Wilde has summarized where the Office found itself in the mid-sixties:

> In twenty-five years the Office du Niger has therefore not achieved the development that was originally expected. The hydraulic infrastructure which had been designed with a view to the development of several hundreds of thousands of hectares today irrigates only 50,000 hectares. Moreover, the cultivation of rice and cotton under irrigation continues to encounter technical and economic difficulties. The administration, which includes almost 2,500 permanent employees is disproportionate to the output obtained and to the active agricultural population which it is responsible for serving. It is perhaps this disproportion between the original goal and the actual accomplishment that provides the fundamental explanation of the great instability in the policy of the Office and of its unsatisfied search for a technical economic and human equilibrium.
>
> The Office du Niger has always been anxious to realize its initial ambition to create an island of prosperity. However, conditions in the Office have been such as to make it difficult to reconcile the interests of the peasants and the financial responsibilities of the Office as an enterprise. Living conditions in the Office have never really attracted the farmers; the comparatively enviable income obtained by the settlers went hand in hand in certain regions with a progressive increase in indebtedness to the Office. The latter has always had to be subsidized in order to finance even its current operations. The Office has thus never been capable of amortizing or earning a return on the public capital invested in the enterprise which in terms of CFA francs of constant value amounted, in 1960, to about 44 billion ($175 million).[2]

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[1] West Africa Rice Development Association (WARDA), "Mali: Office du Niger Identification Report, Final Edition, June 1974 and de Wilde et al. "Mali: the Office du Niger - An Experience with Irrigated Agriculture: in Experiences wit Agricultural Development in Tropical Africa, Vol. II: The Case Studies. Baltimore, the Johns Hopkins Press, 1967.

[2] de Wilde, op. cit., pp. 246-7.

Past disappointments aside, the drought years did illustrate the value of the Office's total, rather than partial, irrigation system. While the low level of the Niger River reduced the portion of the Riz Mopti and Riz Ségou systms that could be irrigated to only about 20 percent, the Office had no such problem.[3] In 1972-73, at the height of the drought, the Office had increased its share of domestic rice produciton to 65 percent, compared to 26.5 percent only four years before. In the post-drought period, however, with rapidly increasing production from the Rice Operations, as a result of investment by FED and the World Bank, the Office no longer accounts for such a large percentage. In 1975-76 it is estimated to have harvested around 38 percent of domestic production.

Fundamental Problems

While an annual output of 100,000 T of paddy is a welcome achievement, the Office still suffers from three fundamental problems.

(1) The irrigation system was designed on the basis of inadequate data and this made it difficult to level fields and irrigate properly. Furthermore, the capacity of the canals is inadequate, a situation that has been made more serious in recent years by poor maintenance. For example, we visited one block in the Niono sector where the main distribution canal had recently been cleaned or dredged. An excellent job had been done, but the farm laterals from the distribution canal had not been repaired. They had deteriorated to such an extent that the lateral banks were only a few inches higher than the land to be irrigated. The laterals were overgrown with weeds and had silted in considerably.

(2) Drainage problems exist because of the lack of maintenance of small drainage canals by the farmers and the fact that equipment for the maintenance of the large drainage canals has broken down or is non-existent. Severe drainage difficulties of another type are found in the Kolongo sector, where they have led to the abandonment of some 5,000 ha. The WARDA study

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[3] In 1972-73 the rice acreage cultivated in the Office was 95 percent of what it had been in 1970-71. The following year it was 101 percent. WARDA, op. cit., p. 10.

envisages two possible solutions, both of which sound drastic: either pumping, since the Niger River is higher than the drain when the paddy fields need to be emptied, or else diversion of the drain to a depression 30 km away. There are serious drainage problems at the northern (Kourouma) end of the system as well. In fact, it is the Niono sector, which benefitted from improved levelling of land, or "super-levelling", when it was largely devoted to cotton production,[4] that is in the best shape.

(3) The primary problem that limits production is a high weed population. Rhizomatous wild rice has caused difficulties for some time. de Wilde saw a shift from the customary broadcasting of seed to transplanting as a solution. This was in fact tried, but the labor demands of transplanting were considered to be too heavy by the tenant farmers, and the experiment was abandoned. Drilling of seed is another technique that would be effective against weeds by permitting weeding between the rows. To date this has been attempted only on the fields farmed directly with hired labor by the Office, using tractor-drawn seeders. In 1976-77 the Office is going to try a small hand-drawn seeder on plots farmed by tenants.

When it comes to marketing, the Office is not exempt from the financial constraint that we discovered almost everywhere. Funds for paddy purchases from tenant farmers arrived very late in the 1975-76 season. Some farmers who needed cash soon after the harvest were obliged to sell their paddy locally for as little as 25 MF/kg since the Office was not yet in a position to buy it officially at 40 MF. (It is worth noting that in 1974-75, when the producer's price rose to 40 MF/kg, the response from tenant farmers was so great that the Office surpassed all projections and finally stopped buying when it had reached 65,000 T of paddy.)

Consolidation Rather than Expansion

In light of these continuing problems the Office has been adhering to a policy of consolidating the existing network before trying to expand. From the completion of the infrastructure in 1947, the Office was in a period of nearly continuous expansion. Not long after Independence in 1960, the

[4]Cotton production was entirely abandoned in favor of rice in 1970.

Soviet Union provided assistance and China began development of the sugar-cane sector at Dougabougou. By 1964 the area developed for irrigation covered about 50,000 ha. Some 12,000 ha of that amount were lying fallow or were not cultivated because of deficiencies in irrigation or drainage. Little was added in the next 12 years, however. In 1976 there are around 55,000 ha developed, 10,000 ha of which are considered to have been abandoned. The area cultivated in the 1975-76 crop year was divided between 40,000 ha in rice and 1,800 in sugar cane.

What is interesting about the acreage in rice is that the Office has steadily moved away from direct farming, where yields have always been low, in favor of tenant farming. In 1963-64, 9,500 ha were given over to direct rice farming and 19,800 ha were cultivated by tenants. (Tenants also had 6,600 ha of cotton in those days).[5] In 1975-76 only 1,578 ha were farmed directly in addition to 454 ha devoted to seed multiplication. The former will drop to only 700 ha in 1976-77, and the latter increase to 504 ha. It is worth noting also that the change toward tenant farming clearly signifies a move away from the increasing mechanization that has characterized the direct farming operations.

Compared to the rest of the country, including many of the Operations, the Office is well endowed in extension personnel. In 1974-75 it had 15 ingénieurs, 20 techniciens supérieurs and 200 moniteurs and encadreurs. (See section I (J) on extension Services). More experienced moniteurs are chefs d'unité in charge of opening canal gates to the secondary canals. The remainder are responsible for the farm laterals. The average number of hectares for each moniteur is hardly more than 200. With the number of hectares per tenant farm family averaging 9, the average moniteur has about 25 farm units with which to deal. Considering the novelty of irrigation and animal traction for new tenants, however, the extension service is not too dense. The Office appears to be concerned about the general level of motivation and competence of its extension personnel and has recently begun a re-training program using instructors from outside the Office.

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[5] de Wilde, op. cit., pp. 260-1.

The Needs of the Office

As the system is viewed from the Office du Niger's administrative headquarters in Ségou, the principal need at the present time is for heavy equipment to clean and dredge the canals. The Office maintains that it has a sufficient number of trained operators to do the job if they can be provided with equipment. Saudi Arabia has agreed to provide $3 million, and it was announced in June 1976 that the Persian Gulf Emirates would grant additional amounts.[6]

Headquarters is also concerned about the Office's milling capacity. Three existing mills are working with three shifts and have a capacity of 48,000 T of paddy. A fourth mill is now under construction at N'Débougou. It will be able to mill 17,000 T of paddy but even so will bring the total capacity of the Office only to the point where it equals the marketed output of the last two years. The 1974-78 Plan calls for two more rice mills in the Office, each with 20,000 T capacity, but neither has been financed. If the European Development Fund were to approve the security stock project that has recently been proposed to it, this would mean construction of one mill, with 30,000 T capacity, perhaps somewhere in the Office.

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[6]Reported in Afrique Nouvelle, Dakar, No. 1406, 9-15 June 1976, pp. 5-6.

Appendix C

TECHNOLOGY PACKAGES AND YIELD EXPECTATIONS

Sorghum and Millet

Farmer varietal identification of sorghum and millet has been lost after years of planting the same seed. Most farmers, except pilot farmers in an Operation, plant year after year from seed of last parentage. In time the worst of the inherited plant genes surface and are in evidence in stored grain and seed being planted.

Present farmer varieties exhibit poor standability, susceptibility to leaf diseases, smut, poor head development and are low yielding. The situation is similar with pearl millet. Present millet varieties are tall[1] with low yield potential.

Results at IRAT agricultural experiment stations in Mali and those of pilot farmers in Operations suggest that with sorghum varieties, seed treatment and animal-driven equipment for plowing, weeding and hilling, yields could increase to 1400 kg/ha from the 500-800 kg/ha average obtained with traditional varieties and practices. 100 kilograms of ammonium phosphate fertilizer (16-48-0) and 50 kilograms of urea (46-0-0) per hectare could further increase yields up to 1800 kg/ha with normal rainfall in the 900-1100 mm zone.

Results from pilot farmers and IRAT research in the Séno area show farmer pearl millet yields could be increased from 300 kg/ha to 900 kg/ha through improved seedbed preparation, weeding, seed treatment and through use of an improved variety. When 100 kg/ha of ammonium phosphate fertilizer (16-48-0) and 50 kg/ha of urea (46-0-0) are applied 30 days after emergence, yields of 1400 kg/ha could be expected with normal rainfall distribution. Rainfall distribution is a problem, however, on the Séno plain, and yields frequently suffer.

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[1] Tallness may result in less grain per plant than dwarf varieties, but long stalks can be woven into thatch and used in construction.

Table iv. Sorghum Package Combination and Yield Expectation*
(900-1100 mm Rainfall)

	Grain Yield (kg/ha)
Traditional methods**	700
Plus: seed treatment	800
Plus: animal traction (toolbar) thorough weeding	1200
Plus: improved variety planting density	1400
Plus: 100 kg/ha ammonium phosphate and 50 kg/ha urea 30 days after seeding	1800

*Sorghum estimates based on discussions with IRAT research staff and results of pilot farmers in Operation Baguineda and Ségou area.

**Traditional methods include hand seedbed preparation, one weeding, low plant population and light applications of manure.

Table v. Pearl Millet Package Combination and Yield Expectation*
(600-700 mm Rainfall)

	Grain Yield (kg/ha)
Traditional methods**	300
Plus: seed treatment	400
Plus: animal traction (toolbar) through weeding	700
Plus: improved variety planting density	900
Plus: 100 kg/ha ammonium phosphate and 50 kg/ha urea 30 days after seeding	1400

*Millet estimates based on discussion with IRAT research staff and results of pilot farmers in Operation Mils-Mopti.

**Traditional methods similar to those for sorghum.

Table vi. Pearl Millet Package Combination and Yield Expectation*
(900-1100 Rainfall)

	Grain Yield (kg/ha)
Traditional methods**	700
Plus: seed treatment	800
Plus: animal traction (toolbar) through weeding	1100
Plus: improved variety planting density	1300
Plus: 100 kg/ha ammonium phosphate and 50 kg/ha urea 30 days after seeding	1700

*Millet estimates based on discussions with IRAT research staff and results of pilot farmers in OACV zone.

**Traditional methods as above.

Table vii. Operation Baguineda Work Calendar, Agricultural Campaign 1976-77
(Sorghum and Millet)

Soil Preparation: Animal plowing June 1 - 15.

Date of Seeding and Spreading of Ammonium Phosphate Fertilizer: June 15-30.

Date of Weeding: 10 days after seeding, 2nd weeding 15 days after 1st weeding.

Date of Reseeding: 8 days after emergence.

Date of Thinning: 15 days after emergence; 3 plants per hill (50 cm x 100 cm) 60,000 plants/ha.

Date of Spreading Urea: 30 days after emergence.

Date of Ridging: 45 days after seeding.

Date of Harvest: 45 - 50 days after full flowering.

Wheat[2]

Products milled from wheat are growing in popularity in Mali. Products include bread, spaghetti, pastry and crackers. Importation of wheat flour was 27,000 metric tons in 1975. Very little wheat is being produced in Mali. Experimental work with wheat is being conducted near Diré, in the Sixth Region. Wheat has been grown on a limited basis by farmers under irrigation during the cool season (November to March) for many years.

Between 1924-1929 five thousand hectares were grown under irrigation. In recent years many newer varieties of spring and durum wheats have been under experimentation in a 3-hectare area. Better varieties have yielded 3500 kg/ha in trials conducted near Diré. The wheats are earlier maturing varieties, planted in mid-November and harvested in March. These yields are consistent with those obtained in similar studies conducted by OMVS in the nearby Senegal River Basin.

Mali would like to become more self-sufficient in wheat production. An "Action Wheat" program has been designed to place 5000 hectares of wheat under irrigation near Diré. The pilot program is planned for 200 hectares.

Maize

Shorter maturing varieties (75-80 days) are being produced successfully as far north as Kayes in the 500-600 mm rainfall zone. Yields have ranged from one ton per ha under traditional methods to 2.5 ton/ha under the best growing conditions and management.

In higher rainfall areas longer-maturing maize varieties are recommended. Yields of 3.5 tons per hectares have been achieved in experimental trials.

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[2] T. Moscal, "La Culture Irriguée du Blé en Zone Ouest Sahelienne." UNDP/FAO/OMVS, June 1975.

Table viii. Maize Package Combination and Yield Expectations*
(800-1100 mm Rainfall)

	Yield kg/ha
Traditional methods	700
Plus: seed treatment animal traction (toolbar) Plant density (80 cm x 40 cm - thin to two plants)	1400
Plus: 100 kg ammonium phosphate at planting plus 100 kg urea at 30 days plus 50 kg urea at 50 days	2800

*Estimates based on discussion with IRAT research staff and results of experimental trials.

Peanuts

Technology that has made this crop attractive to farmers includes: (a) varietal improvements -- discussed in section I(I), (b) a good fit in the crop rotation (crops that follow peanuts have higher yields than those following cereal grains), and (c) improvement of weed control.

Table ix. Peanut Package Combination and Yield Expectations*
(900-1100 mm Rainfall)

	Yield kg/ha	
	Ségou	Kolokani
Traditional methods**	500	600
Plus: early seeding improved seed good weed control seed treatment	1000	1200
Plus: animal traction (1 pair of oxen) tool bar for weeding and lifting seeder grub out 2 ha integrated livestock (Kolokani) 65 kg/ha 0-21-0	1500	1600

*Yield estimates based on research and results of pilot farmers in Ségou and Kolokani sectors of OACV.

**Traditional methods include hand soil preparation, one weeding, low plant population and minimum crop management.

Rice

Paddy, deep water (floating) and upland rice are all produced in Mali. In the South where rainfall is spread over a six-to-seven month period, it is possible to have both rainfed cultivation and deep-flooded cultivation in swampy areas.

Farmer rice yields are estimated to be from 500 kg/ha to 2500 kg/ha. Depth of water, weed control and fertilizer use are important considerations in the resulting rice yields.

In the semi-controlled rice schemes of Operation Riz Ségou and Operation Riz Mopti, the land is plowed by animal traction with the first rains. After plowing the land is harrowed from one to three times to smoothen the seedbed. Improved rice varieties are broadcast, and the land is harrowed again to incorporate the seed into the soil. The rice grows under rainfed conditions for the first 45 days. With the rise of the Niger River about August 15, gates in the dikes are opened and the planted acreage flooded.

Weeds are a major problem. Yields can be greatly reduced by wild rice and other weeds if they are not controlled. Pilot farmers in Operation Riz Ségou plant in rows with seeders. This permits animal-driven cultivation before the land is flooded. Pilot farmers also use 50 kg/ha urea fertilizer, and some of them have obtained yields of 2 to 3.5 T/ha.

Birds are a serious problem in some years both at seeding and when the grain is maturing. At planting time the birds scratch out the seed and at harvest eat maturing grain. Farmers cut the rice by hand and mechanical threshers are brought to the field for harvest.

Table x. Rice Package Program for Semi-Controlled-Water Rice*

	Yield kg/ha
Traditional	500
Plus: improved seed animal traction harrowing	1400
Plus: planter for seeding in lines, cultivator for weeding 100 kg/ha urea fertilizer (46-0-0)	1900

*Yield information based on results of farmers and pilot farmers in Operation Riz Ségou. Yield estimates above are lower than projected by Operation Riz Ségou because of the uncertainty of river rise.

Appendix D

SELECTED BIBLIOGRAPHICAL REFERENCES

I. Non-Public Sources

Food and Agriculture Organization (FAO). Etude Prospective pour le Développement Agricole des Pays de la Zone Sahelienne, 1975-1990. 3 volumes. Rome, 1976.

_____/International Bank for Reconstruction and Development Cooperative Programme. Draft Report of the Mali, Upper Niger Valley Integrated Rural Development Project Preparation Mission. 2 volumes. May 1974.

International Bank for Reconstruction and Development (IBRD). Economic Development in Mali: Evolution, Problems and Prospects, Vol. 1. May 20, 1970.

_____. Economic Memorandum on Mali. Washington, May 1976.

_____. Projet de Développement Rural Intégré-Mali. Washington, May 1974.

_____. Recent Economic Developments in Mali. Washington, September 1973.

_____. Special Sector Survey: Emergency Grain Reserves for the Sahelian Countries. Washington, June 1975.

_____. Regional Mission in Western Africa. "Mali: Review of Agricultural Investment Plans" by R. Güsten. Abidjan, April 1976.

International Monetary Fund. Mali: Recent Economic Developments. Washington, July 1973.

Mali, République du Institut d'Economie Rurale. Etude des Structures de Prix et des Mecanismes de la Commercialisation des Mils et Sorghos. 3 volumes. Suresnes (France): IDET-CEGOS, May 1976.

_____. Ministère du Développement Rural. Stock de Sécurité, Projet Céréalier Prioritaire: Demande de Financement au Fonds Européen de Développement: Bamako, February 1976.

Société d'Etudes pour le Développement Economique et Social (SEDES). Attempt to Outline an Anti-Drought Strategy in the French-Speaking Sahelian Countries of Western Africa, Summary of the Main Report. Paris, October 1975.

II. Unpublished Reports and Documents

Beazer, W.F. and Stryker, J.D. "Financing Recurrent Expenditures for Livestock Development in Mali." Report prepared for the Government of Mali and US/AID. February 1976.

Becker, John A. "An Analysis and Forecast of Cereals Availability in the Sahelian Entente States of West Africa." Report for US/AID. January 1974.

Bingen, R. James. "Some Preliminary Thoughts on Farmer Training in the Republic of Mali." Article submitted for publication to Rural Africana, African Studies Center, Michigan State University. January 1976.

Bloch, Peter C. and Bagayoko, Abou. "Report on a Study of the Education and Training Component of the Mali Livestock Sector Grant." Prepared for US/AID.

C.E.E.M.A.T./S.E.A.E. Etude de l'Evolution des Facteurs de Production Mise en Place Pendant les Dix Dernières Années et de Leurs Effects. November 1972.

Charreau, Claude. Soils of Tropical Dry and Dry-Wet Climatic Areas of West Africa and Their Use and Management. Prelimiary Draft. A Series of Lectures at the Department of Agronomy, Cornell University. Spring 1974.

Crawford, Eric W. "Rural Development in the Fifth Region/Operation Mil-Mopti Area." Report prepared for US/AID. Washington, Development Alternatives Inc. July 1975.

Daves, Thomas E. "Technical Advisory Report on the WARDA-Mopti Rice Research Project Proposal." Report prepared for US/AID. November 1975.

France, République de. Ministère de la Cooperation. Mission de restructuration de l'office des produits agricoles du Mali (OPAM). Nouvelle Edition. Paris: Bureau pour le Développement de la Production Agricole (BDPA), May 1975.

_____. Secrétariat d'Etat aux Affaires Etrangères. Amélioration de riziculture en submersion libre au Mali- delta central du Niger, Rapport de Mission. Paris: BDPA, January-February 1970.

_____. Secrétariat d'Etat aux Affaires Etrangères. L'Approvisionnement des Villes dans les Pays Francophones d'Afrique, Enquêtes et Perspectives, volume V. Bamako. Paris: SEDES December 1972.

Horowitz, M.M. and Stryker, J.D. "A Socio-Economic Framework for the Establishment of a Long-Term Development Strategy in the Sahel." Preliminary Draft. US/AID, May 1976.

International Bank for Reconstruction and Development. "A Note on Transport Problems in the Sahel." Washington, August 1975.

Institute des Recherches Agronomiques Tropicales et des Cultures Vivrières (IRAT) - Mali. "Experimentation Agronomique sur les Phosphates Naturels de Tilemsi en Conditions de Culture Seche: Point de Recherches."

International Crops Research Institute for Semi-Arid Tropics (ICRISAT). International Sorghum Co-operative Nurseries. Sorghum Improvement Program. Hyderabad, India, 1976.

Lewis, John. "The Status of the Ox-Drawn Plow in Dukolomba." April 1975.

Mali, République du. Commission Nationale de Planification de l'Economie Rurale (CNPER) Secrétariat. "Project de Plan Quinquennal 1974-78: La Politique des Prix et les Couts des Produits Agricoles." Bamako, March 1974.

_____. Ministère du Développement Rural, Institut d'Economie Rurale (IER). "Couts Moyens de Production des Principaux Produits Agricoles Pour la Fixation des Prix aux Producteurs de la Campagne 1976/77." Bamako, June 1976.

_____. Ministère du Developpement Rural, Service de l'Agriculture, Operation Baguineda, Divison de la Vulgarisation Agricole. Rapport d'Activité Agricole, Campagne Cerealière 1975-76, An Ka Nyo Baara.

_____. Ministère de la Production, Direction Nationale de l'Agriculture, Operation Riz Ségou. Rapport de Synthèse. Campagne Agricole: 1974-75.

_____. Ministère de la Production, Direction Nationale du Génie Rural. "Commission de Planification: Potentialités Techniques des Irrigations au Mali." Rapport provisoire.

_____. Ministère de la Production, Direction Nationale du Génie Rural, Institut d'Economie Rurale. Etude Diagnostic des Possibilités Hydroagricoles de la Vallée du Sénégal dans la Région de Kayes. Paris: Société Centrale pour l'Equipement du Territoire (SCET - International), March 1975.

_____. Ministère de la Production. Etude de Factibilité du Projet Riz Mopti (2éme Phase). August 1975.

_____. Ministère de la Production. Etude de Reconnaissance de la Vallée du Niger dans la Region de Gao, 5 volumes. Paris: Société d'Aide Technique et de Coopération (SATEC), April 1975.

_____. Ministère de la Production, Institut d'Economie Rurale. Enquête Agro-Socio Economique dans la Zone d'Extension de l'Operation Riz Ségou. Volume II, annexes. Bamako, July 1975.

_____. Ministère de la Production, Institut d"Economie Rurale, IRAT. Bilan Technique et Financier des Recherches en Matière d'Agronomie Générale et de Cultures Vivrières Conduites par l'IRAT de 1962 à 1974 au Mali. Bamako, June 1974.

_____. Ministère de la Production, Institut d'Economie Rurale, Projet de Développement Agricole dans la Zone Sud (Mali-Sud): Rapport de Factibilité, Dossier Principal. Bamako, June 1974.

_____. Ministère de la Production, Institut d'Economie Rurale, Projet de Développement de la Production des Semences Sélectionnés au Mali. Rapport de Factibilité. Bamako, January 1975.

_____. Ministère de la Production, Institut d'Economie Rurale. Rapport de Factibilité de l'Opération Arachide Cultures Cerealières. 7 volumes. Bamako, January 1973.

_____. Ministère de la Production. Projet de Travaux d'Amenagement Hydro-Agricole. Bamako, July 1975.

_____. Ministère de la Production. Rapport Annuel: Campagne Agricole 1974-75 en Zone Cotonnière.

_____. Ministère des Transports et des Travaux Publics. Etude des Transports. Bamako-Kayes, Rapport de la Phase 1. 2 volumes. UNDP, IBRD. Louis Berger International, Inc. 1976.

_____. Projet de développement rural intégré "le Kaarta": Evaluation de projet présentée à l'Agence Canadienne de Développement Internationale. Ottawa, November 1974.

Montgomery, Roger. "The Economics of Fertilizer Use on Sahelian Cereals: The Experience in Mali and Upper Volta." Report for US/AID, 1976.

Moscal, T. La Culture Irriguée du Blé en Zone Ouest Sahelienne, (Manuel à l'Intention des Techniciens). Saint-Louis, Senegal: PNUD/FAO/OMVS, June 1975.

Opération Archide et Cultures Vivrières (OACV). S/Projet Elevage, Koulikoro: "Note sur le S/Projet Elevage de l'OACV (Campagne 1975/1976)." May 1976.

Opération Riz Ségou, C.O.C. Sansanding. "Etude du Milieu: Sansanding, Analyse des Resultats des 58 Enquêtes Famiales." February-March 1973.

Palm and Belloncle. "Le Système Educatif Malien: Analyses et Recommendations." Rapport Provisoire de la Mission UNESCO.

Robbins, G.L. and Garvey, W.E. Millet and Sorghum Price Policy and Related Marketing Problems in Mali. Economic Research Service, U.S. Department of Agriculture Cooperating with US/AID, Field Report 13, April 1972.

Sanogo, Abdoulaye. "Memoire de Fin d'Etudes: Evolution de l'Agriculture dans les Zones de l'O.A.C.V.: Etude Comparative d'une Exploitation de Pointe d'une Exploitation en Système Traditionnel." Ministère de l'Education Nationale, I.P.R. Katibougou, December 1975.

Sargent, Merritt. "Institut de Recherches d'Agronomie Tropicale (IRAT): Research on Cereal Production Technology in Senegal and Upper Volta." Final Report for US/AID. September 1974.

SCET International, SEDES, ORSTOM. Possible Strategies for Controlling Drought in the West Africa Sahel: A Survey. Summary of consolidated report. January 1976.

Seydoux, L. and Damien, P. Développement Intégré de la Zone Diré Goundam (6ème Région), Synthèse des Etudes de la Zone Lacustre - Rive Gauche, 4 volumes. Bamako, 1970.

Stryker, M.D. and Shepherd M.G. "Le Système des Incitations et l'Avantage Comparatif de l'Agriculture et de l'Industrie au Mali." June 1975.

Traoré, Bakary, "Programme de Travaux à Haute Intensité de Main d'Oeuvre dans le Secteur Rural." Bamako: Ministère du Développement Rural, Institut d'Economie Rurale, Cellule de Planification, February 1976.

United States Agency for International Development (US/AID). Annual Budget Submission, FY 1977 - Mali. Washington, July 1975.

_____. Development Assistance Program FY 1975, Section Three: Senegal, Mali, Mauritania. March 1975.

_____. "Mali Crop Production Project." Feburary 1975.

_____. "Mali Crop Production: Subproject 'Action Riz-Sorgho', Gao." July 1976.

Van de Belt, Hans. "Agricultural Innovation and Village Structure; a case study among the Bambara of Koulikoro, Mali."

West Africa Rice Development Association (WARDA). "Mali: Office du Niger." Indentification Report, Final Edition. June 1974.

_____. "Kolimbiné - Lac Magui: Etude de la Situation Agricole et de l'Amélioration du Régime Hydraulique." Author and date unknown.

III. Public Sources

Afrique Agriculture. Mensuel d'informations agricoles. Paris: issues of February, May and June 1976.

Berg, Elliot. The Recent Economic Evolution of the Sahel. Prepared for US/AID. Ann Arbor: Center for Research on Economic Development, the University of Michigan, June 1975.

Brasseur, Gerard. "Etude de Géographie Regionale: Le Village de Tenentou," Notes et Documents, Bulletin de l'I.F.A.N., T. XXIII, ser. B, nos. 3-4. 1961.

Caldwell, John C. The Sahelian Drought and its Demographic Implications. Washington: Overseas Liason Committee, American Council on Education, Paper No. 8, December 1975.

de Wilde, John C. et al. "Mali: the Office du Niger--an Experience with Irrigated Agriculture: and "Mali: the development of Peasant Cotton Production by the CFDT" in Experiences with Agricultural Development in Tropical Africa, Vol. II: the Case Studies. Baltimare: Johns Hopkins Press, 1967.

France, République de. Secrétariat d'Etat aux Affaires Etrangères, Chargé de la Coopération. Dossier d'Information Economique: Mali 1972-1973. Paris, March 1974.

Hopkins, Nicholas S. Popular Government in an African Town-Kita, Mali. Chicago: the University of Chicago Press, 1972.

Joyse, S.J., and Beudot, F. Elements de Bibliographie Sur la Secheresse au Sahel or Elements for a Bibliography of the Sahel Drought. Paris: OECD Development Centre, 1976.

Lele, Uma. The Design of Rural Development: Lessons From Africa. A World Bank Research Publication. Baltimore: the John Hopkins University Press, 1975.

Leynaud, Emile. Les Cadres Sociaux de la Vie Rurale dans la Haute Vallée du Niger. Étude Sociologique, BDPA, volume II. 1961.

Mali, République du. Comité National de la Recherche Agronomique, Institut des Recherches Agronomiques Tropicales et des Cultures Vivrières. Mission IRAT: Rapport Synthétique de la Campagne 1975-1976. Bamako, April 1976.

_____. Comité National de la Recherche Agronomique, IRAT Rapport de la Campagne 1974-1975, volumes 1 and 2. Bamako, April 1975.

_____, CNPER. Rapport Final de la Commission Nationale de Planification de l'Economie Rurale: Pour l'Elaboration du Plan Quinquennal 1974-78. Part I: Situation de l'Economie Rurale Malienne en 1972 and Part II: Programme du Secteur, 2 volumes. Bamako, no date.

_____. Direction Générale du Plan et de la Statistique. Plan Quinquennal de Développement Economique et Social, 1974-1978. August 1974.

_____. Direction Nationale du Plan et de la Statistique. Annuaire Statistique 1972. Bamako, June 1975.

_____. Direction Nationale du Plan et de la Statistique. Comptes Economiques du Mali, 1971. Bamako, March 1974.

_____. Direction Nationale du Plan et de la Statistique. Rapport de l'Enquête Agricole, 1972-1973. Bamako, June 1975.

_____. Ministère du Développement Rural, Service de l'Agriculture. Opération Archide et Cultures Vivrières: Campagne 1974-1975: Secteur de Kita.

_____. Ministère du Développement Rural, Service de l'Agriculture. Opération Arachide et Cultures Vivrières: Compte Rendu de la Campagne Agricole 1974-1975. Bamako, December 1975.

_____. Ministère du Développement Rural, Service de l'griculture. Opération Arachide et Cultures Vivrières: Synthèse du Compte Rendu de la Campagne Agricole 1974-1975. Bamako, December 1975.

_____. Service de la Statistique Générale, de la Comptabilité Nationale et de la Mécanographie. Bulletin Mensuel de Statistique. Bamako, various issues through November-December 1974.

Notes et Etudes Documentaires, nos. 4081-4082-4083. "Le Mali." La Documentation Française. Paris, April 1974.

Organisation for Economic Co-operation and Development (OECD). An Analysis and Synthesis of Long Term Development Strategies for the Sahel. Paris, March 1976.

Organisation pour la Mise en Valeur du Fleuve Sénégal (OMVS). Le Programme de l'O.M.V.S., Presentation, Methodes et Moyens de Mise en Oeuvre. Dakar, May 1976.

Pollet, E. La Société Soninké (Dyahunu, Mali). Brussels: Editions de l'Université de Sociologie, Université Libre de Bruxelles, 1971.

Purdue University. Annual Report on Inheritance and Improvement of Protein Quality and Content in Sorghum. West Lafayette, Indiana: January 1974 - March 1975.