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The Policy Environment and Fertilizer Sector Development in Mali: An Assessment

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Acronyms and Abbreviations

ADB	African Development Bank
ARPON	Amélioration de la Riziculture Paysanne dans l'Office du Niger
ASAP	Agricultural Sector Adjustment Program
AV	Association Villageois (Village Associations)
BAD	Banque Africaine de Développement (African Development Bank)
BCEAO	Banque Centrale des Etats de l'Afrique de l'Ouest (Central Bank of West African States)
BDM	Banque du Développement du Mali (Development Bank of Mali)
BIAO	Banque Internationale pour l'Afrique Occidentale
BMCD	Banque Malienne de Crédit et de Dépôts (Credit and Deposit Bank of Mali)
BNDA	Banque Nationale de Développement Agricole (National Agricultural Development Bank)
BOAD	Banque Ouest Africaine du Développement (West African Development Bank)
CCCE	Caisse Centrale de Coopération Economique
CFDT	Compagnie Française pour le Développement des Fibres Textiles (Cotton Textile Development Company of France)
CILSS	Comité Inter-Etats de Lutte Contre la Sécheresse dans le Sahel (Interstate Committee for Drought Control in the Sahel)
CMDT	Compagnie Malienne pour le Développement des Textiles (Malian Textile Development Company)
COMADIS	Comptoir Malien de Distribution (Malian Distribution Company)
COMANAV	Compagnie Malienne de Navigation (Malian Navigation Company)
COMATEX	Compagnie Malienne des Textiles (Malian Textile Company)
DIAPER	Diagnostic Permanente
DNA	Direction Nationale de l'Agriculture (National Directorate of Agricultural)
DNSI	Direction Nationale de la Statistique et de l'Informatique (National Directorate of Statistics and Information)
DRA	Direction Régionale de l'Agriculture (Regional Directorate of Agriculture)

Acronyms and Abbreviations

(Continued)

DRA-M	Direction Régionale de l'Agriculture de Mopti (Regional Directorate of Agriculture, Mopti)
FAO	Organisation des Nations Unies pour l'Alimentation et l'Agriculture (Food and Agriculture Organization of the United Nations
FCFA	Franc de la Communauté Financière Africaine (African Financial Community's Franc)
FM	Franc Malien (Malian Franc)
GDP	Gross Domestic Product
IDA	International Development Agency
IER	Institut d'Economie Rurale (Institute of Rural Economy)
ILO	International Labor Organization
IMF	International Monetary Fund
MAEE	Ministère de l'Agriculture, de l'Elevage et de l'Environnement (Ministry of Agriculture, Livestock, and the Environment)
NGO	Nongovernmental Organization
ODIB	Opération de Développement Intégré de Baguineda (Integrated Development Operation of Baguineda)
ODIK	Opération de Développement Intégré du Kaarta (Integrated Development Operation of Kaarta)
ODIMO	Opération de Développement Intégré du Mali Ouest (Integrated Development Operation of West Mali)
ODIPAC	Opération de Développement Intégré de la Production Arachidière et Céréalière (Integrated Development Operation for Groundnut and Cereal Production)
ODR	Opération de Développement Rural (Rural Development Operation)
OHV	Opération de la Haute Vallée/Office Haute Vallée (Upper Valley Operation)
OMM	Opération Mil Mopti (Millet Operation, Mopti)
ON	Office du Niger (Niger Office)

c

Acronyms and Abbreviations

(Continued)

OPAM	Office des Produits Agricoles du Mali (Office of Agricultural Products, Mali)
OPSS	Opération Production de Semences Ségou
ORM	Opération Riz Mopti/Office Riz Mopti (Rice Operation, Mopti)
ORS	Opération Riz Ségou (Rice Operation, Ségou)
OVSTM	Opération Vallée du Sénégal, Térékollé, Magui (Sénégal, Térékollé, and Magui Valley Operation)
OZL	Opération Zone Lacustre
PIRT	Projet d'Inventaire des Ressources Terrestres
PR	Phosphate rock
PRMC	Programme de Restructuration du Marché Céréalier (Program for Restructuring the Cereal Market)
SAP	Structural Adjustment Program
SAPA	Structural Adjustment Program for the Agricultural Sector
SAPPE	Structural Adjustment Program for Public Enterprises
SCAER	Société de Crédit Agricole et Equipment Rural (Society for Agricultural Credit and Rural Equipment)
SEPOM	Société d'Exploitation des Produits Oléagineux du Mali
SEPT	Société pour l'Exploitation des Phosphates du Tilemsi (Society for the Exploitations of Tilemsi Phosphate Rock)
SOE	State-Owned Corporation and Enterprises
SOLIMA	Société Libo-Malienne
SOMIEX	Société Malienne d'Importation et d'Exportation (Malian Society for Import and Export)
SONAREM	Société Nationale des Ressources Minières (National Society for Mineral Resources)
SONATAM	Société Nationale des Tabacs et Allumettes du Mali

d

Acronyms and Abbreviations

(Continued)

TPR	Tilemsi Phosphate Rock
UMOA	Union Monétaire Ouest Africaine (West African Monetary Union)
USAID	United States Agency for International Development

Chapter 1

Introduction

1.1 Rationale

Mali is a vast, landlocked country in the Sahelian zone of West Africa. Over 80% of its total population, estimated at 8.3 million in 1991, is dependent on agriculture, which accounts for approximately 50% of gross domestic product (GDP) and a substantial proportion of foreign exchange earnings. Growth in the agricultural sector is limited by low rainfall, fragile soils, and low-productivity traditional technologies. Increasing pressure on the land, caused mainly by rapid population growth, has led to decreasing per capita arable land and shortened fallow periods. Consequently, maintenance of soil fertility and the prevention of soil loss and environmental degradation through better management practices have become the greatest challenges facing farmers and agricultural policymakers alike.

It is widely recognized throughout sub-Saharan Africa that fertilizer is a key input in the restoration of soil fertility, the increase in agricultural production to ensure food security and the successful technological transformation and commercialization of subsistence agriculture. The benefits of fertilizer use are well documented (Baanante, Bumb, and Thompson, 1989). In a period of rapid population growth, marked by declining and in some cases negative growth rates of per capita agricultural production, any hope to reverse the trend must necessarily be based on the adoption of appropriate policies for tackling the most severe constraints on growth of fertilizer use. Inappropriate policies have sustained inefficient public resource management and aggravated distortions in the structure of economic incentives.

It is obvious, but nevertheless worth re-emphasizing, that accelerated economic development in Africa rests on agriculture. Increases in production will depend on both crop and animal production. However, while this report concentrates on crop production, it must be remembered that livestock production is an important element of many farming systems and the predominant one in some.

Productivity increases in Mali, as well as in other sub-Saharan African countries, will depend on four major factors needed for agricultural development: incentives, inputs, institutions, and infrastructure. These four factors are highly interrelated, and each contributes in unique and important ways to agricultural development. In fact, sustainable agricultural development will remain an utopian goal if simultaneous development of these four factors is undermined. As Coulter (1991) succinctly sums up, "if incentives are lacking, farmers will not purchase inputs; they will resort to 'mining' the soil; if institutions are weak, farmers cannot get good advice; if infrastructure is poor the farmer can only obtain inputs at an inflated price while selling his products at a deflated price."

The "Policy Environment and Fertilizer Sector Development" is one of *three* research issues being studied under the Africa Fertilizer Policy Research Project for Mali. The other two research issues are: "Food Security and Fertilizer Use" and "The Agronomic Potential of Fertilizer Use."

The main justification for studying the policy environment is the urgent need to evaluate and redesign existing policies to achieve effectiveness in promoting equitable, efficient, and environmentally safe growth in fertilizer consumption in Mali. Moreover, to the authors' knowledge, there has been no study examining the impact of economic policies on fertilizer sector development in Mali.

1.2 Objectives of Study

Various studies have indicated that the policy environment plays an important role in promoting agricultural growth and economic development. Furthermore, some of these studies suggest that without the existence of a conducive policy environment, growth in fertilizer use is difficult, if not impossible. A conducive policy environment was the major force behind rapid growth in fertilizer use in many countries in Asia in the 1980s, whereas a nonconducive policy environment induced deceleration in growth in fertilizer use in Latin America and Africa (Bumb, 1991). Hence, the main objectives of this study are as follows:

1. Analyze the evolution of the policy environment related to the fertilizer sector development in Mali.
2. Assess the conduciveness of the policy environment.
3. Identify policy-related constraints and suggest measures to remove such constraints.
4. Develop a fertilizer policy strategy for Mali.

1.3 Nature and Scope

Although several policies and related components influence fertilizer use, supply, and prices, seven policies have been selected for analysis. These policies have been selected on the basis of theoretical and empirical evidence discussed in detail in Chapter 5. Only selected components under each policy are analyzed. However, each policy and its related components are analyzed from the point of view of its impact on the fertilizer sector operations. The seven policies selected for an in-depth analysis and assessment are as follows:

1. Macroeconomic policy.
2. Pricing and subsidy policy.
3. Supply policy.
4. Organizational policy.
5. Credit policy.
6. Research and extension policy.
7. Environmental policy.

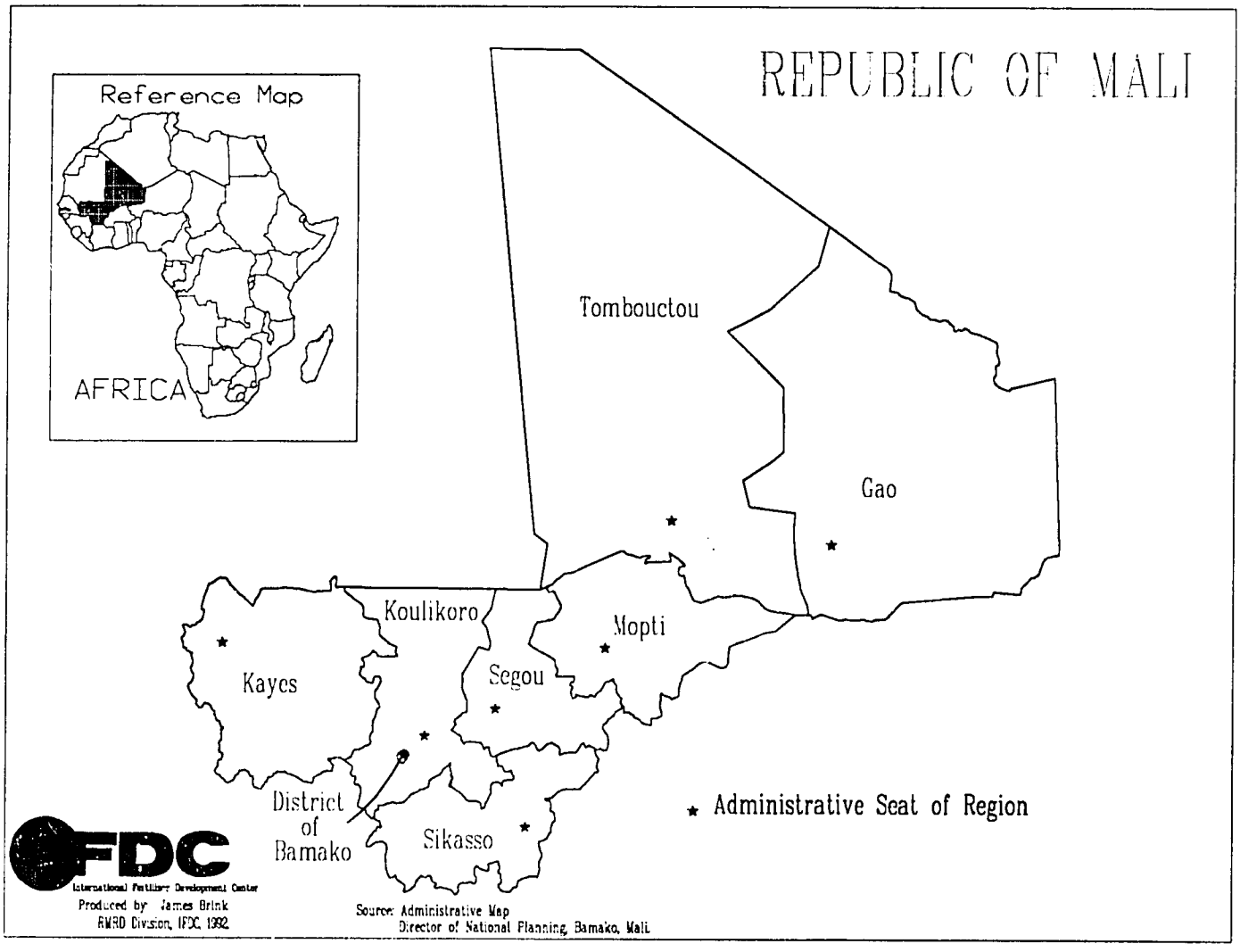
1.4 Study Sample

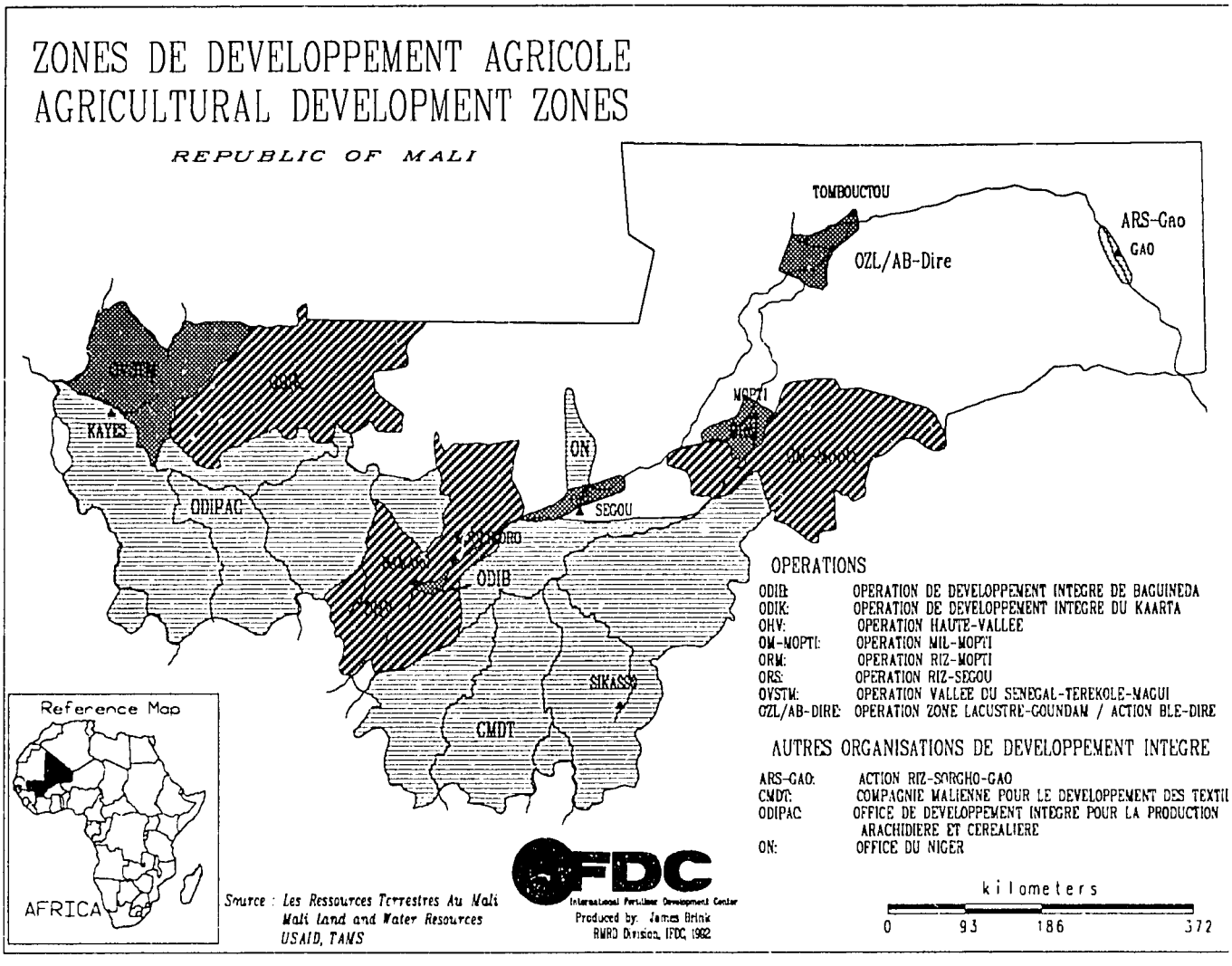
Until 1991, Mali was divided into seven administrative regions[1] and the district of Bamako (Map 1). However, Mali's agricultural and rural development programs are designed and implemented by integrated rural development agencies known as "Opération de Développement Rural" (ODRs) (Map 2). First introduced in 1967, the ODR concept was based on:

1. An integrated approach to development geared to improving the standard of living of farmers while preserving the environment.
2. The creation of organized developmental structures for implementing development projects and providing agricultural services (Ministère de l'Agriculture, 1987).

Thus, with the exception of the "Opération de la Haute Vallée (OHV), all ODRs were created with a specific mandate consisting of either development of production of a

[1]In 1991, a new administrative region was created. Because this study covers the 1970-90 period, most of the analysis is based on seven regions.


REPUBLIC OF MALI
Reference Map
AFRICA
Tombouctou
Gao
Koulikoro
Mopti
Kayes
Segou
District of Bamako
Sikasso
Administrative Seat of Region
IFDC
International Fertilizer Development Center
Produced by: James Brink
RMRD Division, IFDC, 1992
Source: Administrative Map
Director of National Planning, Bamako, Mali


ZONES DE DEVELOPPEMENT AGRICOLE
AGRICULTURAL DEVELOPMENT ZONES
REPUBLIC OF MALI
TOMBOUCTOU
ARS-Gao
GAO
OZL/AB-Dire
KAYES
ODIPAC
ON
SEGOU
MOPTI
ODIB
SIKASSO
CMDT
Reference Map
AFRICA
OPERATIONS
ODIB: OPERATION DE DEVELOPPEMENT INTEGRE DE BAGUINEDA
ODIK: OPERATION DE DEVELOPPEMENT INTEGRE DU KAARTA
OHV: OPERATION HAUTE-VALLEE
OM-MOPTI: OPERATION MIL-MOPTI
ORM: OPERATION RIZ-MOPTI
ORS: OPERATION RIZ-SEGOU
OVSTM: OPERATION VALLEE DU SENEGAL-TEREKOLE-MAGUI
OZL/AB-DIRE: OPERATION ZONE LACUSTRE-GOUNDAM / ACTION BLE-DIRE
AUTRES ORGANISATIONS DE DEVELOPPEMENT INTEGRE
ARS-GAO: ACTION RIZ-SORGHO-GAO
CMDT: COMPAGNIE MALIENNE POUR LE DEVELOPPEMENT DES TEXTI
ODIPAC: OFFICE DE DEVELOPPEMENT INTEGRE POUR LA PRODUCTION ARACHIDIERE ET CEREALIERE
ON: OFFICE DU NIGER
Source : Les Ressources Terrestres Au Mali
Mali land and Water Resources
USAID, TAMS
IFDC
International Fertilizer Development Center
Produced by: James Brink
RMRD Division, IFDC, 1992
kilometers
0 93 186 372

single crop, e.g., cotton by the Compagnie Malienne pour le Développement des Textiles (CMDT), groundnut by the Opération de Développement Intégré pour la Production Arachidière et Céréalière (ODIPAC, now known as the Office de Développement Intégré du Mali Ouest [ODIMO]), rice by the Office du Niger (ON) and the Office Riz Mopti (ORM), and so on, or development and management of irrigated areas by ON and ORM. OHV was the only ODR created initially to work on various aspects of the agricultural development process. To a large extent, ODRs are state organizations with financial and managerial autonomy. They were established either with the assistance of an ongoing project, or as development projects (Ministère de l'Agriculture, 1987).

Because these ODRs are responsible for implementing various agricultural and rural development programs in various zones, it was decided to select *five* representative ODRs for this study.[2] The selected ODRs are:

1. Compagnie Malienne pour le Développement des Textiles (CMDT).
2. Office du Niger (ON).
3. Office Haute Vallée (OHV).
4. Office Riz Mopti (ORM).
5. Direction Régionale de l'Agriculture de Mopti (DRA-M).

Of these five agencies, four (CMDT, ON, OHV, and ORM) are strictly rural development operations (ODRs) with specific mandates for either crop production or irrigation development. DRA-M, on the other hand, is one of six Directions Régionales de

[2]The names of some ODRs have changed; for example, the Opération de la Haute Vallée (OHV) has become the Office Haute Vallée. Hence, OHV implies both of these names.

l'Agriculture (DRA); the other five are DRA Kayes, DRA Koulikoro, DRA Ségou, DRA Tombouctou, and DRA Gao.

When the ODRs were created as semi-autonomous rural development agencies, DRAs were also created to provide agricultural services to farmers in the "zones diffuses" or zones not covered by the ODRs. Thus, DRA-M is basically a research and extension agency without any responsibility for crop production or resource management. Activities and responsibilities of each selected ODR are described below.

CMDT–Created in October 1974, CMDT is a joint venture, limited liability company. The Government of Mali owns 60% of the shares and the Compagnie Française pour le Développement des Fibres Textiles (CFDT) owns 40%. The capital of CMDT has risen from 100 million FCFA in 1975 to an estimated 1 billion FCFA as of September 30, 1988.

CMDT's mission is to promote integrated development in its zone of intervention. The CMDT zone covers the Ségou, Sikasso, and Koulikoro administrative regions of Mali (Map 1) and lies between the 10th and 14th north parallel and the 4th and 10th meridian west. The zone covers approximately 96,000 km^2 or roughly 8% of the national territory. The total population in the CMDT zone is estimated at 2,324,000 inhabitants, of whom 96% are rural. In the 1991/92 cropping season, there were an estimated 176,111 farming units, of which 135,738 received extension services from CMDT.

To accomplish its mission, CMDT endeavors to meet the following main objectives:

1. To increase production of cotton and all other crops grown in rotation with cotton, particularly millet, sorghum, and maize, to achieve crop diversification that is both agronomically and economically sound.

2. To make available to farmers effective extension services and adequate credit for the purchase of farm equipment and other agricultural inputs aimed at generating farm income and ensuring food self-sufficiency at the household level.
3. To develop efficient integration of crop and livestock farming.
4. To provide education and training to rural populations through literacy programs, promotion of rural craftsmen, and young agriculturalists in view of creating and developing new skills.
5. To encourage the creation of a network of organized villages (called Village Associations), which will eventually assume responsibility for organizing production and other functions performed by existing extension service.
6. To modernize farming by improving the labor force and animal traction by progressive introduction of motorization.
7. To encourage sound farm management by developing simple accounting and analytical tools that farmers can master.
8. To organize crop marketing and stock management in the CMDT zone.
9. To develop farm technologies for processing agricultural products (e.g., flour mills, threshing machines, hulling machines, oil presses, etc.).

ON–Created in 1932 by the colonial administration, the Office du Niger occupies a central position in the Malian economy. ON was established in an effort to efficiently utilize the irrigable lands of the Niger Delta. Its zone of operations covers the prefectures of Niono and Macina in the administrative region of Ségou. Initially, 53,000 ha was managed under irrigated rice cultivation with total water control and four rice mills installed for transformation of paddy rice. The major objectives of ON include:

1. Improvement of farm incomes through development of rice production.
2. Proper management and maintenance of water resources.
3. Education, technical training, and organization of farmers.
4. Supply of agricultural inputs and essential agricultural services to farmers in the ON zone of operation.
5. Hulling and marketing of paddy rice.

The ON zone lies within the Sudano-Sahelian belt, and the rainy season lasts from May/June to the end of October. Normal rainfall is about 500 mm per year. The major crop in this zone is paddy rice. Other crops include maize and vegetables.

OHV—Created in September 1972 under the name of Opération Haute Vallée, this ODR is now known as Office Haute Vallée (OHV). Its mission is to undertake integrated development and to create organized developmental structures for implementing development projects and providing agricultural services to farmers in the OHV zone of operations. OHV spans two administrative regions, namely, Sikasso and Koulikoro, and covers an area of 31,530 km^2, representing 2.5% of the national territory and 11% of the national area under rainfed agriculture.

The principal crops grown in the OHV zone are maize, millet, sorghum, tobacco, and cotton. Other crops include paddy rice grown in the flooded lowlands and groundnut. The climate in this zone is of the Sahelian type in the north, and of the north-Sudanian type in the south. Yearly rainfall varies from 600 mm in the north to 1,300 mm in the south.

ORM—Formerly known as Opération Riz Mopti, the Office Riz Mopti is an offshoot of the Opération Riz Ségou (ORS), which spanned the administrative regions of Sikasso, Ségou, and Mopti. Created in March 1972, ORM's mandate was and still is to promote rice

production in the Mopti region through proper management and maintenance of irrigation infrastructure. ORM covers an area of about 45,000 km^2, and its zone of operation is divided into four subzones, namely, Mopti-South, Sofara, Mopti-North, and Tenenkou. Average rainfall in this zone is about 500 mm per annum (550 mm around Mopti).

DRA-M–Although ODRs were created to carry out integrated rural development projects, the Directions Régionales de l'Agriculture (DRAs) continued to provide agricultural services to the "zones diffuses" or those zones that are not covered by the ODRs. However, the DRAs have not benefitted from project funds, and their budget allocations are inadequate to permit them to render comprehensive and effective services to farmers. Unlike the ODRs, DRAs are not developmental agencies but rather service (research and extension) and advisory agencies.

DRA-Mopti was created in 1986/87 and is located between the 14th and 16th parallels north and covers an area of 77,000 km^2. The climate is Sudano-Sahelian in the south, with average annual rainfall of 600 mm, and Sahelian towards the north with average annual rainfall between 200 mm and 400 mm. Principal crops grown in this zone are millet, sorghum, maize, paddy rice, fonio, and groundnut.

1.5 Data Sources and Limitations

Secondary data are used in this study. Most data and information on fertilizer consumption, fertilizer prices, crop production, area planted, and crop yields were obtained from documents published by the ODRs. Macroeconomic and supplementary data and information were obtained from various sources including the Direction Nationale de l'Agriculture (DNA), the Direction Nationale de la Statistique et de l'Informatique (DNSI),

Banque Centrale des Etats de l'Afrique de l'Ouest (BCEAO), Banque Nationale de Développement Agricole (BNDA), the Food and Agriculture Organization of the United Nations (FAO), International Monetary Fund (IMF), and the World Bank.

The major problems faced with the data collection activity are (1) inconsistencies in the data on the same variables from different sources; (2) missing data, causing severe discontinuities in data series; and (3) lack of relevant data. Briefly, data and information needed on important variables were either not available, or were available but in conflict with those from other "official " sources. It is therefore crucial to emphasize at this point that the analyses in this study are, at best, suggestive. Improving the quality and coverage of data collection is essential for strengthening future policy analysis work in Mali.

Of the five ODRs selected for study, only two (CMDT and OHV) had fairly consistent data series (1980-90) on most of the variables of interest. Therefore, only CMDT and OHV were used for in-depth analysis of the pricing and supply policies.

1.6 Outline of the Study

In addition to this introductory chapter, the study contains six other chapters. Chapter 2 presents the general macroeconomic setting, and Chapter 3 discusses the role of agriculture in the national economy. These two chapters are intended to provide a broader context for the developments in the fertilizer sector because many policies and developments in these two areas have direct and indirect impacts on the activities and operations in the fertilizer sector.

Chapter 4 provides an analysis of trends in fertilizer use, imports, prices, marketing and distribution, and other indicators in the sector. The analytical framework for evaluating

various components of the policy environment is discussed in Chapter 5. The evolution of the policy environment and the factors causing changes in the policy environment in Mali are analyzed in Chapter 6. This chapter also provides an assessment of the policy environment. Specifically, it evaluates every policy from the point of view of its impact on the fertilizer sector operations. It then classifies each policy as conducive, neutral, or nonconducive to fertilizer sector development in Mali during the selected time periods.

The major findings and conclusions of the study are summarized in Chapter 7.

Chapter 2

The Macroeconomic Setting

2.1 Introduction

Like all sectoral analysis, fertilizer sector development is best analyzed within the framework of the macroeconomic development for three important reasons. First, macroeconomic developments tend to influence the macroeconomic policy environment within which fertilizer sector development takes place. Second, the macroeconomic factors are capable of providing serious constraints on the demand and supply of fertilizer and, hence, on the use of fertilizer in the country. Third, developments in the macroeconomy often provide the rationale for the adoption of sector policies aimed at increasing agricultural productivity, which invariably leads to increased use of fertilizer.

Among macroeconomic factors of interest are the following:

- Population (its rate of growth, projections, and age composition).
- The growth of macroeconomic aggregates such as the gross national product (GNP), GDP, employment, inflation, and the standard of living.
- Exports, imports, the balance of payments, and debt burden.
- The issues of poverty, hunger, and malnutrition.
- Macroeconomic factors such as fiscal, monetary/financial, trade, and payment variables.

2.2 Population

According to the population census taken by the Direction Nationale de la Statistique et de l'Informatique (DNSI), the Malian population increased from 6,394,918 inhabitants in 1976 to 7,696,348 in 1987. This increase represents an annual growth of 1.85%, whereas the annual rate of population growth during the 1960-80 period was estimated at 2.5%. Table 2.1 provides the rural-urban composition of population in 1976 and 1987.

Table 2.1. Mali: Rural and Urban Population, 1976 and 1987

	1976		1987	
	Million	%	Million	%
Rural	5.3	83	6.0	78
Urban	1.1	17	1.7	22
Total	6.4	100	7.7	100

Source: DNSI.

It is clear from Table 2.1 that urban population increased at a higher rate than rural population. The urban population increased by 5.2% annually, whereas the annual growth in the rural population did not exceed 1.2%. In spite of higher growth in urban population, Mali remains predominantly a rural economy. Hence, the growth in the agricultural sector remains critical to Mali's economic development.

A. Population Density

Population growth and socioeconomic development are closely related. The geographical distribution of population is the end result of several phenomena, among which are socioeconomic, climatic, geomorphologic and historical conditions. Geographic distribution of population serves as a basis to draw the main trends in socioeconomic development or, in other words, a guide to design sound land use planning.

The population of Mali is distributed over seven administrative regions and the district of Bamako. The degree and pattern of land use in each of the seven regions and the district of Bamako are contingent upon the predominant way of life (sedentary or nomadic).

Population density increased in 1987 by 21% compared with the level of 1976, which is a significant increase considering that the area studied in 1987 was 1,248,574 km^2, and the area studied in 1976 was 1,240,000 km^2.

With the exception of Tombouctou, where the population density has slowed down, and Gao, where it has remained unchanged, population density in all regions has increased (Table 2.2). In 1987 Tombouctou had a density of 0.9 persons per km^2, whereas the national average density was 6.2 persons per km^2.

Table 2.2 shows a significant concentration of population in the District of Bamako and in the regions of Ségou, Sikasso, Mopti, and Koulikoro. These high concentrations of population are found mostly in the south of the country, in what constitutes the most productive regions of Mali. In these regions, rainfall and the presence of the Niger River ensure a minimum of water supply. Population densities in these regions vary between 13 and 21 inhabitants per km^2 while population densities do not exceed 1.2 inhabitants per km^2 in Gao and 0.9 inhabitants per km^2 in Tombouctou.

Table 2.2. Mali: Regional Population Density, 1987

Regions	Population (persons)	Density (persons per km^2)
Kayes	1,067,007	8.9
Koulikoro	1,197,968	12.5
Sikasso	1,310,810	18.7
Ségou	1,339,631	20.7
Mopti	1,282,617	16.2
Tombouctou	459,318	0.9
Gao	380,722	1.2
District of Bamako[a]	658,275	2,612.2
Total	7,696,348	6.2

a. The District of Bamako is a city district consisting of Bamako (Mali's capital) and surrounding areas.

Source: DNSI, *Annuaire Statistique du Mali, 1989* (population figures only).

B. Population Distribution

The analysis of the results of the 1987 census indicates that the youth represent about 77.4% of the total population and account for 80.4% and 76.8% of the urban and rural population, respectively. The high proportion of young people in the urban area is mostly concentrated in the District of Bamako, which accounts for 32% of the urban youth. The reason is that Bamako, with its better developed socioeconomic infrastructures, attracts most of this subpopulation, which is composed of students, undergraduates, and also a mass of young people who rush up to the capital in search of more remunerative occupations.

The low concentration of young people in Tombouctou and Gao is due to the desertic nature of these regions, which compels the youngsters to migrate to the South-West or outside the country in search of a better life.

C. Population by Gender

As in several African countries, the female population is slightly higher in the rural as well as in the urban areas. Table 2.3 provides the distribution of population by gender.

Table 2.3. Mali: Gender Distribution of Population, 1987

	Rural		Urban	
	Million	%	Million	%
Male	2.9	49	0.8	49.5
Female	3.1	51	0.9	50.5
Total	6.0	100	1.7	100

D. Perspectives after 1987

Between the two censuses taken in 1976 and 1987, the actual growth rate of the Malian population was 1.85% which corresponds to approximately half of the natural growth rate estimated at 3.70% per year.

It must be noted that infant mortality rate was particularly high in Mali–almost 200 infant deaths per 1,000 births–and life expectancy did not exceed 45 years.

The Malian population is projected to grow at an annual rate of 1.80% starting from 1987 (Table 2.4). Mali has a high rate of migration to neighboring countries, other African countries, and Europe (France in particular). Using the results of the 1987 census, DNSI

projects that net migration of Malians will occur at the rate of 1.89% per year (3.33% for males and 0.51% for females). It is expected that migration rate will remain constant until the year 2000 but will decrease thereafter to reach 1.75 in the year 2010.

2.3 Trends in GDP

Mali's GDP grew at an annual rate of 6.5% during the 1980-90 period. In absolute terms, GDP increased from 354.6 billion FCFA in 1980 to 677.6 billion FCFA in 1990 (Table 2.5). However, the annual percentage changes in GDP reveal an erratic pattern. GDP grew at a slower rate in 1983, 1985, and 1990. This was due mainly to a decrease in the value added by certain sectors of the economy during these years, particularly the food and industrial crop sectors. The decrease in agricultural production was caused mainly by poor rainfall. During 1984 and 1986-89, adequate rainfall led to increased agricultural production. This is reflected in the relatively higher annual percent changes in GDP associated with these years.

From this analysis it can be safely concluded that GDP growth depends heavily on agriculture, which accounts for about 70% of Mali's GDP. Thus, all measures geared to increase agricultural production, such as increased use of organic and inorganic fertilizers, will definitely increase GDP.

Table 2.4. Mali: Demographic Trends, 1976-92

Year	Total Population	Annual Growth Rate (%)	Urban Population	Rural Population	Total Active Population	Rural Active Population	Population Density (Persons/km^2)
1976*	6,394,918	-	1,076,829	5,318,089	2,238,221	1,861,331	5.1
1980	6,881,434	1.85	1,325,628	5,555,806	2,419,035	1,935,228	5.5
1987*	7,696,348	1.85	1,690,289	6,006,059	3,437,533	2,102,121	6.2
1990	8,120,027	1.80	1,847,024	6,273,003	3,654,012	2,923,210	6.5
1992	8,415,729	1.80	1,959,508	6,456,221	3,726,566	3,019,046	6.7

* Census years.

Table 2.5. Mali: Gross Domestic Product, 1980-90
(billion FCFA)

Year	GDP	% Change
1980	354.6	-
1981	380.6	+7.33
1982	403.6	+6.04
1983	411.3	+1.90
1984	463.5	+12.69
1985	475.4	+2.57
1986	528.4	+11.15
1987	570.7	+8.01
1988	612.2	+7.27
1989	663.0	+8.30
1990	677.6	+2.20

Source: DNSI.

2.4 Employment

During the population census of 1987, the active population was defined to include persons who were 6 years or older.

The active population includes two categories of persons:

- Persons who were employed in the month preceding the census. In the case of the agricultural sector, the reference period is the census year.
- Persons who were not employed during the month preceding the census and who were seeking a paid or remunerative job, including those who have never worked.

The first category of persons constitutes the category of employed active population, while the second category is the unemployed active population (or the unemployed). The results of the 1987 census show that for the whole of Mali 7,696,348 residents were counted, 3,437,533 of whom were active while 4,271,671 were inactive. The remaining 41,144 persons did not declare their type of activity. The active and inactive populations therefore constitute 45% and 55%, respectively, of the total population.

Economic activity in Mali is dominated by the primary sector, which employs 82.2% of the active population. The secondary sector employs 6% of the active population while the tertiary sector, which is relatively larger, employs 11.8%. The results of the census, as far as the informal sector is concerned, indicate that in Mali an estimated total of 496,803 persons are employed. Table 2.6 presents the distribution of employment by category in 1987.

Table 2.6. Mali: Employment, 1987

Category	Number Employed	% of Total
Salaried workers	169,136	34
Family hands (apprentices and others)	107,713	22
Independent (self-employed, partners, and managers)	219,954	44
Total	496,803	100

Source: DNSI.

Approximately 50,000 salaried workers are employed in the Public Service, 20,000 are in State-owned corporations or other firms, 15,000 work in private firms, and the others are

employed by other institutions (nongovernmental organizations, international organizations, diplomatic missions, and international cooperation agencies).

The State-owned corporations and enterprises (SOEs) have recorded a decline in their staff since 1985 following the implementation of the SOE restructuring policy and the collective staff retrenchment entailed therein.

The number of wage earners in private firms has increased since 1981 at an average rate of about 500 per annum. A large number of workers are designated as self-employed. This category of workers includes:

1. Owner-managers of family businesses or principal shareholders serving as directors of private firms. These account for 2% of the self-employed.
2. A small number of professionals, such as lawyers, notaries, chartered accountants, architects, medical doctors, and others. These workers face serious problems relating to the private practice of their professions, particularly the medical doctors.
3. A large number of persons employed in the informal sector. These include artisans, and other non-handicraft self-employed workers engaged in petty transport and distribution business.

The economic activity situation is presented in Table 2.7 based on the results of a survey of the informal sector (DNSI 1990) using indicators such as the activity and unemployment rate based on area, region, and gender.

Table 2.7. Mali: Area Activity and Unemployment Rates, 1990

Area	Indicators[a]			
	DAR (%)	AAR (%)	DUR (%)	AUR (%)
Urban	34.9	36.1	10.2	8.3
Rural	50.1	54.1	0.9	0.7
Overall	46.5	49.8	2.5	2.1

a. DAR: Declared Active Rate (of population).
AAR: Actual Active Rate.
DUR: Declared Unemployment Rate.
AUR: Actual Unemployment Rate.

The declared and the actual active population rates are greater for the rural areas than for the urban areas (50.1% and 54.1% against 34.9% and 36.1%, respectively). On the contrary, both the declared and the actual unemployment rates are higher in the urban areas than in the rural areas (10.2% and 8.3% against 0.9% and 0.7%, respectively). In the urban areas, 102 of 1,000 persons were declared unemployed, whereas only 9 in 1,000 persons were declared unemployed in the rural areas. In both rural and urban areas combined, 25 in 1,000 persons were declared unemployed. Table 2.8 provides information on regional activity and unemployment rates in 1990.

The Sikasso region registers the highest rate of declared active population (59.8%), followed by Tombouctou (54.8%), Koulikoro (50.1%), Mopti (49.0%), Kayes (41.5%), Ségou (39.8%), Gao (36.6%), and the District of Bamako (34.6%). The District of Bamako registered the lowest rate of declared active population but was the hardest hit by unemployment, with a declared unemployment rate of 12.8%.

Table 2.8. Mali: Regional Activity and Unemployment Rates, 1990 (%)

Regions	DAR	AAR	DUR	AUR
Kayes	41.5	51.4	1.8	1.3
Koulikoro	50.1	50.9	2.2	2.0
Sikasso	59.8	62.7	1.1	0.9
Ségou	39.8	42.9	1.3	1.1
Mopti	49.0	49.3	1.9	1.5
Tombouctou	54.8	65.8	2.2	1.7
Gao	36.6	36.8	2.2	2.4
District of Bamako	34.6	34.7	12.8	0.9
Total	46.5	49.8	2.5	2.1

In all the regions, the declared rate of unemployment is less than the national average (2.5%), except for the District of Bamako (12.8%), and Gao region (2.2%). The gender distribution of activity and unemployment rates is presented in Table 2.9.

Table 2.9. Mali: Gender Distribution of Activity and Unemployment Rates, 1990 (%)

Gender	DAR	DUR
Male	75.2	2.4
Female	19.0	3.2
Total	46.5	2.5

It is clear from Table 2.9 that there is a much higher proportion of men than women in the active population. Three of four (75.2%) men are active, whereas roughly one of five (19.0%) women is active. The male declared rate of active population is much higher than the national rate (46.5%). The contrary is true for females: their declared rate of active

population is less than the national average. Evidently, the rate of declared unemployment is higher for women than for men (3.2% against 2.4%).

Employment Perspective

With the implementation of the Structural Adjustment Program (SAP), the Government of Mali put in place a strategy for creating private-sector employment to mitigate the social costs of laying off public-sector workers and to stop registration of the unemployed at the Public Service. As a result, about 6,300 public servants were laid off between 1985 and 1989. To this figure must be added the roughly 12,000 young graduates who are unemployed. In this respect, the revival and promotion of the private sector in the context of the Government's policy on structural adjustment should generate employment for both the young graduates and public servants who were laid off and encourage private entrepreneurship. This economic revival will be facilitated by measures geared to stimulate the creation of small- and medium-scale enterprises (SMEs) and small- and medium-scale industries (SMIs).

To promote job creation and encourage private initiative through the creation of SMEs and SMIs, the Government of Mali has benefitted from significant amounts of aid from different donors, including FAO, USAID, Arab Funds, World Bank, UNDP/UNIDO, UNDP/International Labor Organization (ILO), world cooperation and bilateral aid packages from France, Germany, Canada, Switzerland, and Norway.

At the end of the Donors' Roundtable on Employment in February 1990, the donors made a commitment worth about 50 billion FCFA to the Government of Mali to initiate 250 projects geared to creating jobs.

2.5 Trends in Per Capita GNP

A consistent series of data on Mali's GNP is not readily available. The information provided in this section on per capita GNP is based on World Bank estimates.

Considered as one of the lowest income countries in the world, Mali's per capita GNP was $210 in 1987 (Table 2.10). This amount represented 78% of the average per capita GNP for all low-income economies and 64% of the average per capita GNP for all countries in sub-Saharan Africa. During the 1973-80 period, per capita GNP grew at an annual rate of 4.3%, whereas the 1980-87 period was characterized by lower annual growth rate of 0.7%.

Table 2.10. Mali: Per Capita GNP for Selected Sub-Saharan African Countries, 1987-90

Countries	Per Capita GNP ($)		Average Annual Growth Rate (%)		
	1987	1990	1973-80	1980-87	1965-90
Mali	210	270	4.3	0.7	1.7
Ghana	390	390	-2.1	-2.0	-1.4
Malawi	160	200	1.4	0.0	0.9
Niger	260	310	2.6	-4.9	-2.4
Burkina Faso	190	330	2.5	2.5	1.3
Togo	290	410	1.5	-3.9	-0.1
Sub-Saharan Africa	330	340	0.1	-2.8	0.2
Low-Income Economies	270	350	0.3	-3.6	2.9

Sources: The World Bank:

1. *Sub-Saharan Africa: From Crisis to Sustainable Growth.* A Long-Term Perspective Study, 1989 (for Per Capita GNP in 1987 and Average Annual Growth Rates for 1973-80 and 1980-87).
2. World Development Report 1992 (for Per Capita GNP in 1990 and Average Annual Growth Rates for 1965-90).

In 1990 Mali's per capita GNP was $270. This amount was equal to 79% of the average per capita GNP for all low- and middle-income countries in sub-Saharan Africa and 77% of the average per capita GNP for all low-income economies in the world. During the 1965-90 period, Mali's per capita GNP annual growth rate of 1.7% exceeded that for all low- and middle-income countries in sub-Saharan Africa, estimated at 0.2%.

2.6 Poverty, Hunger, and Malnutrition

In 1990, 77% of the population were rural dwellers who produced nearly 49% of the GDP.

It must be stressed that the two main objectives of the 1987-91 Five-Year Economic and Social Development Plan were:

- Food self-sufficiency and food security.
- Drought and desertification control.

Concerning the first objective, because cereals are important in the average diet of the people (80%), food self-sufficiency is expressed largely in terms of cereal production. Producing as much cereal as possible for the attainment of food self-sufficiency and diversifying food production to provide the people with a balanced diet constitute the basis of food security.

According to the 1988-89 Budget-Consumption Survey conducted throughout the country and covering the entire population, average daily diet corresponded to an energy intake of 2,345 calories, 98% of which are derived from cereal consumption (Table 2.11).

Table 2.11. Mali: Components of the Malian Diet, 1990

Sources of Energy	Optimum Requirement	Average Malian Diet
Sugar	55%-60%	98%
Oils	20%-25%	0.5%
Proteins	12%-15%	1.5%

Source: MAEE, 1992.

The diet appears to be only slightly diversified, as a result of which sugary foods are in excess of the other components. The large nutritional disequilibrium that is responsible for nutritional deficiency affects particularly the vulnerable groups, (children under the age of five and expectant and nursing mothers).

The 1987-91 plan period was characterized by an exceptional increase in cereal production during the 1988/1989 and 1989/1990 farming seasons (Table 2.12).

Table 2.12. Mali: Balance of Domestic Requirements and Domestic Supply, 1986/87-1990/91

Crop Year	Farming Season Results ('000 tons)		
	Millet-Sorghum-Maize	Rice	Total
1986-87	+286.1	-8.1	+278.0
1987-88	+129.7	-59.0	+70.7
1988-89	+448.5	-32.8	+415.7
1989-90	+382.1	-2.1	+380.0
1990-91	+47.8	-84.7	-36.9

Sources: DNA-DNSI.

Table 2.12 shows significant results in cereal production achieved under the food self-sufficiency and food security drive. Self-sufficiency in millet-sorghum-maize has become a reality even if it remains subject to weather hazards.

However, rice production cannot yet guarantee security as national rice requirements are estimated at over 400,000 tons of paddy rice annually. Even if one can dare speak of a revolution in traditional crop production in view of the persistent deficits recorded under the previous plan (1981-85), the danger of a short-term deficit resulting from possible change in weather conditions should not be underestimated. This deficit was recorded during the last farming season thereby highlighting the fragility of the results achieved and the major problems pending even though the national cereal production recorded significant results during the 1987-91 plan period. These problems, which should be dealt with in order to attain the food security target, include the following:

a. Chronic malnutrition, particularly among risk groups, despite the achievement of generally balanced results in cereal production. Indeed, it should be pointed out that the current level of per capita cereal consumption is lower than accepted norms and that consumption requirements are covered by traditional cereal production.

b. The persistence of cereal deficits in rural areas, a phenomenon affecting 130 districts and a population of nearly 1 million inhabitants. There are, in addition, zones in precarious situations with deficits that are either frequent or uninterrupted with regard to some groups.

c. The insignificant progress in diet diversification with the exception of privileged urban groups and rural areas producing cash crops.

Under the optimistic assumption of normal weather conditions, adequate rainfall, and per capita cereal production of 222 kg, the domestic cereal (millet, sorghum, maize, and rice) balance will show a surplus of 690,000 tons by the year 2000. This surplus will decline to 631,000 tons if per capita cereal production is assumed to be 215 kg.

The pessimistic assumption of inadequate rainfall, bad weather conditions, and per capita cereal production of 161 kg would lead to a domestic cereal deficit of 156,000 tons by the year 2000. However, this deficit could be reduced to 102,000 tons with a marginal increase in per capita cereal production–from 161 kg to 165 kg (MAEE, 1992).

Such projections of domestic cereal supply and demand underscore the critical importance of efficient water and land management and use of organic and inorganic plant nutrients and complementary inputs.

Furthermore, the attainment of food security is subject not only to the capacity to harness water resources under irrigation development programs (ON zone, Operation Riz Ségou and Operation Riz Mopti) but also to fertilizer use by smallholders to enhance productivity without increasing acreage, which varies between 1.50 ha and 2.5 ha per family. It is these smallholders who undertake virtually the entire national cereal production.

2.7 Balance of Trade and Balance of Payments

We have reliable information covering only the "1987-91 Five-Year Economic and Social Development Program" period (Table 2.13). Our analysis will therefore center on this period.

Table 2.13. Mali: External Trade, 1987-91
(in billions of FCFA)

	1987	1988	1989	1990	1991
Imports					
Food products	18.3	24.6	22.2	23.5	18.5
Cereal aid	6.3	10.3	5.7	5.8	4.5
Machinery/vehicles	48.7	49.3	52.5	53.6	53.6
Building materials	17.0	16.3	18.7	18.0	18.0
Petroleum products	20.3	19.7	14.7	17.1	14.5
Others	39.7	43.3	50.2	55.9	67.8
Total[a]	144.0	152.8	158.3	168.1	172.4
Exports					
Cotton products	31.9	28.7	43.1	43.6	48.9
Live animals	20.9	22.0	22.3	24.6	27.3
Gold	15.2	12.8	8.1	12.3	14.0
Others	8.9	11.4	12.4	11.5	9.8
Total	76.9	74.9	85.9	92.0	100.0
Balance of Trade	-67.1	-77.9	-72.4	-76.1	-72.4

a. Total imports do not include cereal aid.

Sources: (1) Comptes Economiques du Mali, 1989.
(2) Etat d'Exécution du Plan Quinquennal, 1987-91.

2.7.1 Balance of Trade

The balance of trade deficit worsened from 1987 to 1991 having risen from 67.1 billion FCFA in 1987 to 72.4 billion FCFA in 1991. In 1988, the deficit amounted to 77.9 billion FCFA (Table 2.13).

In 1988, imports increased by +6.1% while exports fell by 2.6% during the same period. Imports rose as a result of the persistent increase in the value of food products (up to 1990) and textiles, machinery, and vehicles.

The increase in exports in 1989, 1990 and 1991 was due to a steady rise in the export of cotton products, live animals, gold, hides and skin, fruits and vegetables. Cotton product

exports expanded significantly by 11.3%–from 43.6 million FCFA in 1990 to 48.9 billion FCFA in 1991. Livestock exports were also satisfactory. Gold exports, for their part, fell by 2% from 15.2 billion FCFA in 1987 to 14.0 billion FCFA in 1991. Reduced gold exports were a result of the decline in output at the Kalana mine, which was flooded in 1988 and 1989. However, there was a slight upturn in gold production from 1990 following the exploitation of the Syama gold mines.

2.7.2 Balance of Payment

Like the deficit in the balance of trade, the balance in the current account also decreased over time (Table 2.14). This decline was due to the decrease in the balance of trade deficit as imports expanded at a slower pace than exports.

Table 2.14. Mali: Balance of Payments, (billion FCFA)

Item	1987	1988	1989	1990	1991
Exports (f.o.b.)	76.9	74.9	85.9	92.0	100.0
Imports (c.i.f.)	-144.0	-152.8	-158.3	-168.1	-172.4
Balance of trade	-67.1	-77.9	-72.4	-76.1	-72.4
Current account balance (including aid)	-28.6	-26.8	-27.8	-31.2	-15.5
Overall balance	-2.1	12.4	33.2	7.5	26.2

Sources: (1) Comptes Economiques du Mali, 1989.
(2) Etat d'Exécution du Plan Quinquennal, 1987-91.

The overall balance of payments position improved significantly in 1987-91 rising from a deficit of 2.1 billion FCFA in 1987 to a surplus of 26.2 billion in 1991. The improved balance of payments position was largely due to substantial nonmonetary capital flows, particularly official flows which shot up from 28.8 billion FCFA in 1987 to 39.7 billion in 1991. It should also be emphasized that outstanding payments have declined from 1990.

2.8 External Debt

Mali's external debt rose from 188 billion FCFA in 1980 to 830 billion FCFA in 1987 and reached an all-time high of 1,055 billion FCFA in 1991 (Table 2.15). Mali's debt situation is a matter of great concern, especially when one compares the debt to the country's available natural resources.

Table 2.15. Mali: External Debt and GDP, 1980-91 (Billions of Current FCFA)

Year	External Debt	% Change	Gross Domestic Product	% Change
1980	187.9	-	354.6	-
1981	246.3	+31.08	380.6	+7.33
1982	311.0	+26.26	403.6	+6.04
1983	402.9	+29.54	411.3	+1.90
1984	545.0	+35.26	463.5	+12.69
1985	535.8	-1.69	475.4	+2.57
1986	536.5	+0.13	528.4	+11.15
1987	830.0	+54.70	570.7	+8.01
1988	880.0	+6.02	612.2	+7.27
1989	1,002.0	+13.86	663.0	+8.30
1990	1,009.0	+0.69	677.6	+2.20
1991	1,055.0	+4.56	730.3	+7.78

Sources: Annuaires Statistiques, and Comptes Economiques for the Years 1980-90. DNSI.

As the figures in Table 2.15 indicate, Mali's external debt has increased in absolute value at a compound annual growth rate of 15.7% between 1980 and 1991. This debt is made up essentially of public debt (over 80%); State-guaranteed private debt is only a small, insignificant proportion of the country's external debt. Mali's external debt is thus composed of long-term financial obligations with the possibility of debt rescheduling or even cancellation. However, the total amount of a country's debt has no economic significance unless the debt is looked at in relation to other macroeconomic variables, such as total population and GDP (Table 2.16).

Table 2.16. Mali: External Debt and GDP Per Capita, 1987-91

Year	Total Population ('000 Persons)	Debt Per Capita (FCFA)	GDP Per Capita (FCFA)	Debt Per Capita/GDP Per Capita (%)
1987	7,696	107,848	74,638	144.4
1988	7,835	112,316	78,135	143.7
1989	7,976	125,626	83,124	151.1
1990	8,120	124,261	83,458	148.9
1991	8,266	127,631	88,350	144.4

Sources: (1) 1987 census (for population figures). Calculations for 1987-91 are based on an annual population growth of 1.8%.
(2) Debt per capita, GDP per capita and ratio of debt per capita to GDP per capital were calculated from data on debt and GDP.

Table 2.16 indicates that during the period of the "Five-Year Economic and Social Development Plan: 1987-1991," per capita external debt exceeded per capita GDP by 44% to 51%.

The distribution of outstanding external public debt by category of creditor as of December 31, 1990, was 47% owed to multilateral lenders and 53% owed to bilateral lenders. Table 2.17 provides the distribution of outstanding public debt by source of financing as at December 31, 1990.

Table 2.17. **Mali: Outstanding External Public Debt by Source of Financing, December 31, 1990**

Creditor	Loan Outstanding at 31/12/90 (Billion FCFA)	%
France	155.3	20.4
IDA	151.2	19.9
USSR	133.2	17.5
BCEAO	63.1	8.3
ADB	58.2	7.7
China	57.1	7.5
IMF	38.3	5.0
Saudi Funds	32.4	4.3
Kuwetian Funds	21.2	2.7
Others	50.0	6.7
Total	760.0	100.0

Source: Caisse Autonome d'Amortissement du Mali.

The distribution of external debt outstanding by economic sector as of December 31, 1990 is presented in Table 2.18.

Table 2.18. Mali: Sectoral Distribution of Outstanding External Debt, 1990

Sector	Share of Outstanding External Debt (%)
1. Finance	47
2. Industry	18
3. Transport, communications, and tourism	13
4. Agriculture	12
5. Education and health	6
6. Others	4

Although debt service (interest payment and amortization of capital) decreased from 29 billion FCFA in 1987 to 19.5 billion FCFA in 1991, debt service absorbs a significant proportion of Mali's export earnings and leads to significant outflows of foreign exchange (Table 2.19). The debt burden thus affects the national budget adversely.

Table 2.19. Mali: Debt Service, 1987-91

	1987	1988	1989	1990	1991
Debt service (billion FCFA)	29.0	19.3	21.2	19.1	19.5
Interest payments (billion FCFA)	16.8	11.1	12.1	9.7	10.3
Principal payments (billion FCFA)	12.2	8.2	9.1	9.4	9.2
Debt service as share of GDP (%)	5.1	3.2	3.2	2.8	2.7
Debt service as share of total exports (%)	37.7	25.8	24.7	20.8	19.5

Source: Caisse Autonome d'Amortissement du Mali.

Mali's visit to the Paris Club enabled the country to reschedule payment of 28 billion FCFA of debt. Mali equally benefitted from debt cancellation totalling about 60 billion

FCFA over the 3-year period from 1988 to 1990. Table 2.20 presents the sources of these debt cancellations and the amounts involved.

Table 2.20. Mali: Debt Cancellations, by Source, 1988-90

Country	Amount of Debt Canceled (billion FCFA)
France	48.000
Federal Republic of Germany	10.352
U.S.A.	1.700
Morocco	0.274
Yugoslavia	0.170

Source: Caisse Autonome d'Amortissement du Mali.

2.9 Evolution of Economic Policies

Mali, like all the other developing countries, has gone through a serious economic crisis. This situation resulted from a combination of external and internal factors. From 1960, the Malian Government implemented a policy based on the public sector. Such a policy called for large funds, which the country could only get through increased internal and external debt. The consequences of that policy were as follows:

- Serious economic imbalances (e.g., budget deficits, external debt, balance of payments difficulties, food insecurity).
- Inefficient resource allocations.
- Slow economic growth.
- Low participation of the private sector in development effort.

Hence, since 1982, the Malian Government has implemented a series of adjustment programs aimed at straightening the economic situation and alleviating persistent constraints in the areas of budget, balance of payments, and economic growth.

Between 1982 and 1987, Mali ratified three standby agreements with the International Monetary Fund (IMF) and an economic reform programme with USAID. From 1988 to 1990, Mali developed in collaboration with its development partners (the World Bank, IMF, and USAID) several reform programs including the structural adjustment of the agricultural sector and the reforms of State-owned companies and enterprises.

2.9.1 Fiscal Policy

During the 1980-90 period, Mali's fiscal revenues increased from 36.3 billion FCFA in 1980 to 75 billion FCFA in 1990. Government expenditures on goods and services increased from 39.6 billion FCFA in 1980 to 100.8 billion FCFA in 1990 (Table 2.21). Hence, fiscal revenues grew at an annual rate of 7.2%, whereas fiscal expenditures grew at 9.3% annually.

A fiscal deficit[3] was reported for every year during the 1980-90 period. Between 1980 and 1990, the fiscal deficit grew at a rate of 20.6% annually. In nominal terms, the deficit increased from 3.3 billion FCFA in 1980 to 25.8 billion FCFA in 1990. The smallest deficits amounting to 2.4 billion FCFA, were reported in 1987 and 1988. The largest deficit was the 25.8 billion FCFA reported in 1990.

Substantial increases in fiscal revenues have occurred since 1987 as a result of increased foreign aid. Fiscal revenues increased from 70.2 billion FCFA in 1986 to

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[3]Overall Government budget deficit, excluding foreign-financed expenditures.

120.4 billion FCFA in 1987 and reached 155.7 billion FCFA in 1990. Between 1980 and 1990, there was a thirteenfold increase in the foreign aid component of fiscal revenues. In nominal terms, foreign aid increased from 5.5 billion FCFA in 1980 to 80.7 billion FCFA in 1990. This implies a 26.8% annual growth in foreign aid during the 1980-90 period.

Table 2.21. **Mali: Evolution of the National Budget, 1980-90 (billion FCFA)**

Year	Fiscal Revenue (a)	Fiscal Revenue Plus Foreign Aid (b)	Fiscal Expenditures (c)	Committed Fiscal Expenditures (d)	Fiscal Deficit (c - a)
1980	36.3	41.8	39.6	41.8	-3.3
1985	53.7	69.1	58.3	69.1	-4.6
1990	75.0	155.7	100.8	168.8	-25.8

Source: DNSI.

2.9.2 Exchange Rate Policy

Before discussing Mali's exchange rate policy, a brief review of the country's monetary evolution is useful. In 1962 Mali, in search of monetary autonomy, left the Union Monétaire Ouest Africaine (UMOA) or the West African Monetary Union to create its own central bank with the Malian franc (FM) as the monetary unit. The FM and the FCFA exchanged at par. Serious financial and economic problems led to a 50% devaluation of the FM in 1967. Mali re-entered the Franc Zone, but not the UMOA, in 1968, and the convertibility of the FM was fixed at a rate of FM 100 = 1 French Franc, or FM 2 = 1 FCFA.

Unwilling to finance Mali's huge budget deficits of the 1970s, France exerted pressure on Mali to return to the UMOA. In June 1984, negotiations were finalized and Mali again

became a member of UMOA, replacing the Malian franc with the FCFA at a rate of FM 2 = 1 FCFA.

Mali has been a member of the UMOA since 1984. This monetary integration among seven West African countries[4] is characterized by:

1. A common currency known as the "Franc de la Communauté Financière Africaine" (FCFA).
2. A common central bank known as the Banque Centrale des Etats de l'Afrique de l'Quest or the Central Bank for West African States (BCEAO).
3. A centralized monetary policy.

An additional particular feature of the UMOA is the fixed exchange rate between the CFA franc and the French franc, which has stayed at 50:1 since 1948.

There are some advantages and disadvantages of UMOA membership. A major advantage of membership in the UMOA is the removal of the foreign exchange constraint as the convertibility of the FCFA is guaranteed by France. A major disadvantage, however, is the loss of national monetary sovereignty as each member is subjected to a common and fixed exchange rate policy as well as to a strict credit policy in order to control members' domestic demand and, hence, their balance of payments deficits. It also results in an overvalation of the domestic currency.

To the extent that an overvalued exchange rate penalizes exports and encourages imports, the resulting excess demand for imported goods can be expected to lead to growing balance-of-payments deficits, a reduction of foreign exchange reserves, and accumulation of foreign debt.

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[4] Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Senegal, and Togo.

Available data (Table 2.22) indicate a sharp currency depreciation against the U.S. dollar throughout the first half of the 1980s. During this period, the exchange rate, expressed in FCFA per U.S. dollar, increased from an average of FCFA 211.3 = $1 in 1980 to FCFA 449.3 = $1 in 1985. The currency appreciation over the 1986-88 period caused considerable problems for Franc Zone countries like Mali, whose major exports are primary commodities priced in U.S. dollars, but whose imports usually originate from European and North American countries with much stronger currencies. The appreciation of currency in the late 1980s made fertilizers relatively cheaper in the late 1980s.

Table 2.22. Mali: Annual Average Exchange Rates, 1980-90
(CFA francs per U.S. dollar)

Year	CFA Francs	Year	CFA Francs
1980	211.3	1985	449.3
1981	271.7	1986	346.3
1982	328.6	1987	300.5
1983	381.1	1988	297.8
1984	436.9	1989	319.0
		1990	272.3

Source: IMF, *International Financial Statistics,* various issues.

2.9.3 Inflation

World Bank estimates indicate that the annual rate of inflation (as measured by the implicit GDP deflator) averaged 3.8% during the 1980-88 period. Table 2.23 presents estimates of inflation rates for Mali for the 1965-91 period. From the table it is clear that the inflation rates were twice as high in the 1965-73 period, and thrice as high in the 1973-80 period than they were in the 1980-88 period.

Table 2.23. Mali: Average Annual Inflation Rates (%)

1965-73	1973-80	1980-88	1988	1989	1990[a]	1991[b]
7.7	10.7	3.8	2.7	1.0	0.9	1.4

a. Preliminary estimates.
b. Forecast.

Sources: The World Bank (1965-89) and DNSI (1990-91).

Fluctuations in agricultural production and food supply affect the level of prices in the Malian economy. For example, the drought-induced food shortages of the 1983-84 cropping season, together with the liberalization of grain marketing, engendered sharp increases in food prices. Furthermore, the change in 1984 from the Malian Franc to the FCFA added upward pressure on prices as most prices were converted at par from their Malian Franc levels into the FCFA (FM 2 = FCFA 1), thereby doubling overnight. Salaried workers were particularly affected as their real incomes with respect to local commodities, including staple grains, was effectively reduced by 50%. Being a member of the West African Monetary Union, Mali benefits from a generally low inflation rate. This is due in part to the monetary discipline imposed by membership of the Franc Zone.

Between 1989 and 1991, the average annual inflation rate was 1.1%. This represents the lowest inflation rate in Mali during the 1965-91 period. It should be mentioned that recently the IMF and the Government of Mali signed a loan agreement of up to 90 million U.S. dollars to support the country's economic reform programs during the 1992-95 period. The goal of the new administration in Mali is to achieve economic growth of 6% in 1992

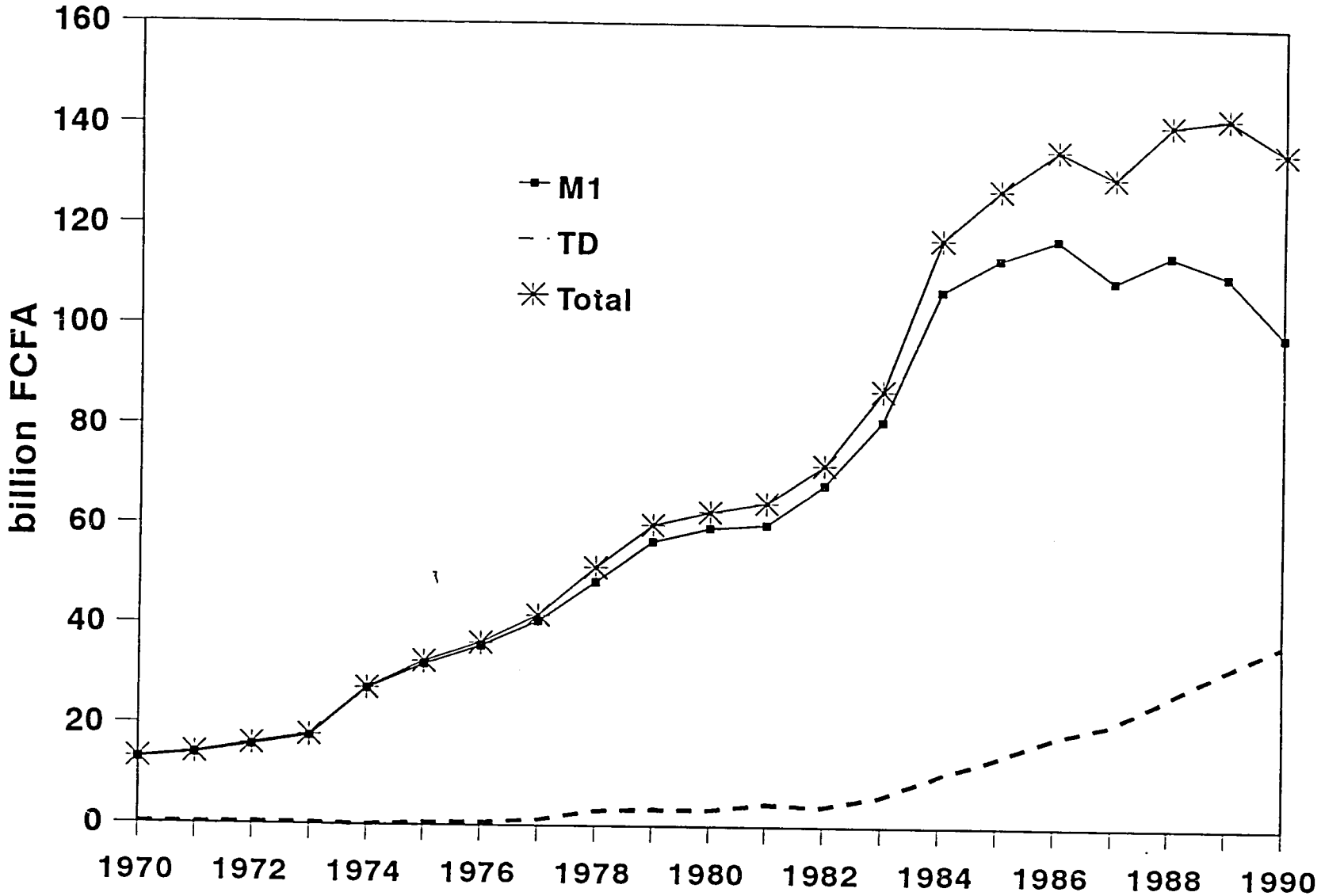
and 4% in 1993 while maintaining the rate of inflation at 2.5% or less (*Jeune Afrique*, 1992, p. 47).

2.9.4 Monetary and Financial Developments

Commercial banking services in Mali are provided mainly by the Banque Malienne de Credit et de Dépôts (BMCD) and by the Banque Internationale pour l'Afrique Occidentale au Mali (BIAO). Huge amounts of government and public enterprise arrears in the 1980s created a severe liquidity crisis in the banking system. The Banque du Développement du Mali (BDM), which had gone bankrupt in 1987 with liabilities amounting to 62 billion FCFA, resumed its activities in July 1989 under Moroccan management after it was bailed out by the Caisse Centrale de Coopération Economique (CCCE) of France (EIU). The BDM is now owned by the Banque Marocaine de Commerce Extérieur, the Government of Mali, the BCEAO, and the Banque Ouest Africaine de Développement (BOAD).

The analysis in this section is based on IMF data. Table 2.24 and Figure 2.1 present information on the money supply in Mali during the 1970-90 period.

Figure 2.1 Mali: Money Supply, 1970-90



Notes: M1 = Currency, demand deposits and deposits with post office.
TD = Time Deposits. Total = M1+TD.
Source: *IMF International Financial Statistics Yearbook 1991.*

Table 2.24. Mali: Money Supply, 1970-90 (billion FCFA)

Year	M1[a]	Time Deposits	Total[b]
1970	12.95	0.23	13.18
1975	31.95	0.57	32.52
1980	59.52	3.28	62.80
1985	113.77	13.81	127.58
1990	98.48	36.57	135.05

a. Notes and coins *plus* demand deposits *plus* post office checking deposits.
b. M1 plus time deposits (or Quasi-Money).

Source: IMF, *International Financial Statistics Yearbook 1991.*

Between 1970 and 1980, M1 grew at an average annual rate of 15.3% (Table 2.25). Time deposits grew at a higher annual rate of 26.6%, while total money supply grew at 15.6% per annum. Annual growth in M1 slowed down considerably between 1980 and 1990, growing at 5%. During the same period, time deposits and total money supply grew at 24.1% and 7.7%, respectively. Between 1984 and 1990, a period characterized by Mali's renewed membership in the UMOA, M1 decreased by 1.4% annually, whereas time deposits and total money supply grew annually at rates lower than the rates of growth experienced during the 1970-80 and 1980-90 periods. The slow growth of the 1984-90 period may be explained in part by the strict monetary policies of the UMOA.

Table 2.25 Mali: Money Supply Growth Rates, 1970-90 (%)

	1970-80	1980-90	1984-90
M1	15.3	5.0	-1.4
Time deposits	26.6	24.1	21.1
Total	15.6	7.7	2.3

2.10 Structural Adjustment Program for the Agricultural Sector (SAPA)

The general objective of SAPA is to promote agricultural growth while diversifying the agricultural production and ensuring the viability of the production system. This program concerns development in priority cereals and cotton because of the importance of these sub-sectors in the Malian economy. The specific objectives of SAPA are the following:

- To improve the national incentive system for the cotton sector and increase its efficiency in order to remain competitive on the international market.
- Reinforce the program for the liberalization of the cereals market to ensure an adequate supply of cereals throughout all the regions in Mali.
- Support the government program of institutional reforms for ODRs in order to improve collection services in the rural areas and lower the burden of these institutions on the national budget.
- Ensure the efficiency of the public investment program in the agricultural sector.
- Rationalize the planning and establishment of priorities for investments in agriculture.

The specific objectives of the investment program are the following:

- To increase agricultural production (cotton, cereals) in northern Mali through the development of a new area, the Bougouni zone, and improve agricultural techniques (fertilizer use) in the South-Mali region.
- To ensure agricultural production sustainability through improved land management practices.
- To diversify agricultural production in the South-Mali region while putting the stress on maize production.
- To rationalize the establishment of priorities for CMDT investment planning.

2.10.1 SAPA Outcomes

The restructuring of the cotton sector has been carried out in the framework of the second Contract-Plan for the 1989/90-1993/94 period, which was signed between the Government and CMDT. To that effect, cotton prices paid to producers by CMDT were revised on the basis of export prices, and the Cotton Stabilization Fund, which aims to alleviate the impact of short-term fluctuations of global cotton prices, has become operational.

In the cereal sector, the restructuring of the Office des Produits Agricoles du Mali (OPAM), whose staff was reduced by half in 1990, has been carried out in the framework of the second Contract-Plan.

On the other hand, very limited progress has been made in the adjustment of the Office du Niger; research and extension services were reinforced in 1991. A progress report on the long-term program for natural resources management has been prepared as well as a plan of action for the development of cattle breeding.

2.10.2 Rural Development Operations Reform

The objective of the program is to rationalize the agricultural sector to make it more efficient. A structural adjustment plan has been developed for ODRs on an individual basis. This plan includes two phases:

- A short-term phase covering the 1988/89 period concerns the reorganization of management structures and systems, the economics of services for supplying goods and services, Government's disengagement from certain functions, the withdrawal of inputs subsidies, and the dissolution of six ODRs.
- A medium-term phase, which covers a period of 3-5 years and aims to implement the means already defined. By June 1990, six ODRs were dissolved: Mil Mopti Operation, Denne Rice-Sorgho Operation, Opération Zone Lacustre (OZL), Dire Wheat Operation, Opération Vallée du Sénégal-Terekole-Magui (OVSTM), and Opération de Développement Intégré de Baguineda (ODIB). The execution of this phase, which was planned for June 1990 has been delayed. The ODRs have been adjusted in the framework of the Contract Plan for CMDT. The restructuring of the Niger Office was done in the framework of the adjustment program and with the assistance of other projects.

The structural adjustment program is now in the implementation phase. While there are still many actions to be taken, the Government is pulling out progressively from economic activities. Subsidies removal and the suppression of deficit activities are now established.

As of December 31, 1991, the objective is to transfer all commercial activities to the private sector and to leave to ODRs only the functions that are the concern of public

services (such as extension, training, and natural resources management programs). The following measures have been proposed.

1. Presentation of detailed propositions for restructuring six other ODRs: ODIK, ORM, ORS, OPSS, OHV, and ODIMO.
2. Transformation of two ODRs (Sukala and Thé Sikasso) into joint-share commercial enterprises.

2.10.3 Structural Adjustment Programme for the Public Enterprises Sector (SAPPE)

This programme aims to:

1. Lower the burden of public enterprises on the national economy and public finance through two means:
   a. Rationalizing public enterprises–by liquidating those that are not viable, disengaging from nonstrategic enterprises, and consolidating those having strategic importance.
   b. Systematically reviewing all new investments on the basis of economic and financial justification.
2. Improve economic and financial performances of viable enterprises through the following means:
   a. The reform of the institutional code for public enterprises.
   b. The rationalization of key sectors, mainly, energy, water, telecommunications, and post.
   c. The restructuring of the financial sector and particularly the Development Bank of Mali (BDM) and restoring liquidity of postal checks.

This program concerns the following 35 public enterprises:

Group 1	Group 2	Group 3
1. COMANAV	1. COMATEX	1. Air Mail
2. EDM	2. EDIM	2. CMTR
3. OERHN	3. EMAMA	3. EMAB
4. OPT	4. Grand Hotel	4. LPM
5. RCFM	5. ITEMA	5. OCINAM
6. SONATAM	6. PPM	6. SAT
	7. SEMA	7. SCAER[a]
	8. SEPAMA	8. SEBRIMA
	9. SEPOM	9. SHM
	10. SMECMA	10. SOCOMA
	11. SOCAM	11. SOCORAM
	12. SOCIMA	12. SOMBEPEC
	13. TAMALI	13. SONEA
	14. UCEMA	14. SONETRA
		15. SOMIEX

a. Was involved in fertilizer imports.

2.10.4 Status of SAPPE

Since the implementation of the programme started, 15 public enterprises have been privatized. All the assets of these enterprises were totally or partially sold. Some of these assets have not been sold yet–mainly the equipment and specialized materials for which it is difficult to find buyers. In the framework of the restructuring of public enterprises, the Government has transferred the total of its assets to joint-share or private enterprises.

Government disengagement or privatization means that the State participation has been limited to 20% (Group 2). Of all the measures that have been planned, privatization is the most difficult one to implement because of the following factors:

- The structure of the Malian economy (underdeveloped).
- Low financial capacity of the private sector.
- Low management capacity of private economic actors.
- Slowness of judiciary and administrative procedures involved in the liquidation and divestiture of enterprises and their financial consequences.

In spite of these difficulties, 7 of 14 public enterprises, namely ITEMA, Grand Hotel, SEPOM, SOCAM, PPM, SOCIMA, and EDIM, have been privatized to date. The other seven (SEMA, COMATEX, TAMAL, UCEMA, SMECMA, SEPAMA, and EMAMA) are in the process of being privatized. Enterprises in Group I remain under the Government's portfolio.

2.10.5 Difficulties in the Implementation of the Different Programs

- Implementation started in 1982, but most of the adjustment measures were not executed until 1989.
- The second difficulty is linked to some discontinuity in the implementation of these measures.
- Third, the lack of statistical data makes it difficult to analyze the impact of these programs on the population. From a social point of view, these programs led to cutbacks in employment and Government expenses, which directly affect the social sector.

It is also important to note that, in order to compensate for the negative effects of structural adjustment measures, a program of voluntary retirement has been planned and executed. A fund for workers' rehabilitation has also been established. In 1991, 3,531 civil servants and military agents were retired.

Chapter 3

Role of Agriculture in the National Economy

3.1. Contribution of the Agricultural Sector to Economic Growth

Table 3.1 summarizes the trend for contributions of the various sectors to national output over the past 10 years.

It is obvious from this table that agriculture remains the most important economic sector in Mali with an average annual contribution of roughly 50% to the GDP.

The breakdown of value added of the primary sector shows a predominance of plant produce (including forestry produce). The share of crop output, comprising food and cash crops, averages 20.3% over the decade under review.

The importance of the primary sector in the national economy also derives from its significant contribution to employment and export earnings.

According to the data in Table 3.2, the agricultural sector engaged, on average, 80% of the economically active population during the 1980s.

Under the prevailing condition, the rural labor force constitutes a key factor in the formation of average incomes even if its productivity increased only slightly between 1980 and 1990.

The impact of the agricultural sector on the balance of payments is another aspect of its leading role in the country's economy. The relevant data are presented in Table 3.3.

Table 3.1. Trend of GDP Structure (% of total)

Item	1970	1975	1980	1981	1985	1986	1987	1988	1989	1990
- Food crops	17.8	14.4	NA	19.0	16.5	17.6	16.3	15.3	16.1	14.1
- Cash crops	5.9	3.5	NA	4.8	3.2	3.9	3.9	3.3	4.5	4.0
- Livestock	20.4	15.4	NA	23.7	16.5	21.0	20.2	21.7	21.9	22.3
- Fisheries	2.8	2.0	NA	2.3	2.1	1.6	1.0	0.9	0.9	1.0
- Forestry	2.9	1.9	NA	8.2	9.0	7.6	7.1	7.2	7.1	7.4
- Total Primary Sector	49.8	37.2	59.0	58.0	47.3	51.7	48.5	48.4	50.5	48.8
Other Sectors	50.2	62.8	41.0	42.0	52.7	48.3	51.5	51.6	49.5	51.2
Gross Domestic Product	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100	100	100

NA = not available.

Source: DNSI.

Table 3.2. **Mali: Population, Employment and Production in the Agricultural Sector, 1981-90**

Item	1981	1983	1985	1988	1990
Total Population ('000 persons)	6,957	7,195	7,442	7,827	8,095
Rural Population ('000 persons)	5,628	5,770	5,915	6,094	6,273
Total Active Population ('000 persons)	2,680	2,904	3,146	3,549	3,845
Rural Active Population ('000 persons)	2,242	2,415	2,602	2,909	3,133
GDP (in constant 1980 prices) (billion FCFA)	367	394.6	424.3	473.0	508.6
Agricultural Sector's Share in GDP (in constant 1980 prices) (billion FCFA)	212	181.5	200.6	228.9	248.1
Rural Productivity (in constant 1980 prices) ('000 FCFA)	94,558	75,155	78,094	78,686	79,189

Source: Rural Sector Development MASTER PLAN "Structural Adjustment and the Rural Sector," MAEE.

Table 3.3. Mali: Balance of Payments and Agricultural Trade Balance, 1987-90

Item	1987	1988	1989	1990
Total Exports (billion FCFA)	76.9	74.9	85.9	93.8
Agricultural Exports (f.o.b.) (billion FCFA)	58.6	56.8	70.8	77.7
Imports of Agricultural Food Items (billion FCFA)	14.8	21.0	14.0	16.5
Imports of Agricultural Inputs and Equipment (billion FCFA)	59.8	63.0	69.7	73.2
% of Total Imports	41.5	41.2	45.1	43.5
Total Agricultural Imports (billion FCFA)	74.6	84.0	83.7	89.7
% of Total Imports	51.8	54.9	54.2	53.3
Balances (billion FCFA)	43.8[a] -16.0[b]	35.8[a] -27.2[b]	56.8[a] -12.9[b]	61.2[a] -12.0[b]
Total Imports (billion FCFA)	144.0	152.8	154.4	168.2
Trade Balance (billion FCFA)	-67.1	-77.9	-68.9	-74.4
Balance of Payments (billion FCFA)	-2.2	12.4	33.1	11.8

a. Includes food items.
b. Includes food items, inputs, and equipment.

Sources: Development Strategies and Constraints in Mali, UNDP 1991.
Rural Sector Development Master Plan, MAEE, January 1991.

These data indicate that, on the average, over 80% of national exports come from the agricultural sector. The overall volume of exports from this sector expanded by roughly 4.6% annually during the past 6 years. A breakdown of the current structure of exports shows that the major cash crops are cotton and fibres, livestock, and small ruminants as well as produce from other crops.

Agricultural imports also represent a significant portion of Mali's total imports (an average of 56.3%). The structure of agricultural imports is strongly influenced by imports of agricultural inputs and implements, which represent 40% of the volume of agricultural imports.

The agricultural trade balance shows a substantial surplus with regard solely to direct food imports. It shows a deficit, however, when imports of fertilizer and agricultural implements are included.

Finally, the importance of the role of the agricultural sector in Mali's economy is also based on the dependence on this sector of a considerable proportion of secondary sector production: agricultural produce processing industries, and agrobased food processing and textile industries, for example, provided 33% and 42% of the added value of the secondary sector, respectively.[5]

3.2 Trend of the Major Agricultural Produce

Table 3.4 presents national trends in cultivated area (A), production (P), and yields (Y) of the major rainfed crops for the 1960-90 period.[6]

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[5] Ministry of Planning : 1987-1991 Five-Year Economic and Social Development Plan of Mali.

[6] The data refer to cropping seasons consisting of split years. Thus, the 1960 data are for 1960-61 and so on.

Table 3.4. Mali: National Trends in Area Planted, Production, and Yields of Major Rainfed Crops, 1960-90

Item	Reference Period							Annual Growth (%)		
	60-65	66-70	71-73	74-79	80-84	85-86	87-90	68-86	76-86	87-90
Mill/Sorgh/Fonio										
A- '000 ha	1490	1270	1155	1275	1370	1595	1796	1.3	2.2	0.6
P- '000 tons	870	780	660	895	835	1290	1393	2.9	3.7	2.5
Y- kg/ha	580	615	570	700	610	810	776	1.6	1.5	1.9
Maize										
A- '000 ha	105	85	110	105	95	125	152	2.2	1.8	6.0
P- '000 tons	85	85	55	75	85	200	196	5.0	10.3	7.3
Y- kg/ha	820	1000	500	710	890	1600	1289	2.7	8.5	-2.8
Paddy Rice										
A- '000 ha	145	160	145	180	145	180	221	0.7	0.0	6.4
P- '000 tons	165	150	135	225	145	210	272	1.9	0.9	3.2
Y- kg/ha	1120	940	930	1250	1000	1600	1231	1.2	0.0	0.9
Grand Total										
A- '000 ha	1740	1515	1410	1560	1610	1900	2169	1.3	2.0	1.6
P- '000 tons	1120	1015	850	1195	1065	1700	1861	3.0	3.7	3.3
Y- kg/ha	640	670	600	765	660	900	858	1.7	1.6	1.7
Cotton										
A- '000 ha	60	85	75	100	110	145	179	3.1	3.8	9.5
P- '000 tons	20	45	60	110	130	180	235	8.2	5.0	8.4
Y- kg/ha	330	530	800	1100	1180	1240	1313	5.0	1.2	-1.1
Groundnuts										
A- '000 ha	225	170	160	170	115	95	136	-3.4	-5.7	14.1
P- '000 tons	130	120	125	150	75	85	116	-1.9	-5.5	17.4
Y- kg/ha	580	700	700	880	650	890	853	1.4	0.1	3.3

Source: DNA and DNSI published in *Statisques de Base*: OSCE (for 1960-65, source DNA).

The data highlight significant variations of production parameters as a result of rainfall conditions. An analysis of yields in the last two sections of the table indicates that the lowest results were obtained during the 1971-73 and 1980-84, which were periods of drought.

On the whole, food crop production improved during the 1976-86 period. Cereal crops meant for domestic consumption (millet, sorghum, and maize) resisted the weather hazards more successfully. Millet and sorghum production increased by an average of roughly 3.7% per annum owing, above all, to the expansion in the area of land under cultivation (2.2% per annum). Maize production increased unevenly from 1% to 3% annually on area that had expanded at an annual average rate of 1.8%. Only rice production experienced a decline. Apart from the inclement weather condition, the rate of decline, which was about 0.9% per annum, was reportedly due to technical and organization problems affecting the major irrigation schemes (Office du Niger). The food crop farming systems have on the whole remained unproductive except in the case of maize whose yield increased by 8.5% annually.[7]

Agricultural raw material production was characterized by a steady and significant increase in cotton output and a substantial decline in groundnut production. Cotton production increased by 5% annually over acreages that increased by 3.8% annually. Consequently, yields increased by almost 1.2% annually.

These overall results of Mali's agricultural production conceal the significant regional disparities. With regard to the dynamism of local production systems, performances are more positive in the southern, central, and west central regions where the climatic conditions

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[7]Most of this increase occurred in the CMDT zone.

appear to be most suitable for settlement and climatic conditions are better. The changes observed in acreage and per capita production of cereals between 1978 and 1985 are presented in Table 3.5. Regional disparities are also observed in yields of major crops in 1990 (Table 3.6).

Table 3.5. **Mali: Regional Distribution of Cereal Area and Production Per Capita, 1978 and 1985**

Item/Region	Kayes	Koulikoro	Sikasso	Ségou	Mopti	Tombouctou
Area per capita (ha)						
1978	0.26	0.16	0.18	0.38	0.28	0.10
1985	0.18	0.18	0.23	0.29	0.18	0.17
Cereal Production per capita (kg)						
1978	130	150	130	335	155	20
1985	105	225	245	255	145	20

Source: DNSI - quoted in *Revue du Secteur Agricole*, Ministère de l'Agriculture, 1987.

Table 3.6. **Mali: Regional Yields per Hectare, 1990 (kg/ha)**

Region	Millet/Sorghum	Maize	Paddy Rice	Cotton	Groundnut
Kayes	1,264	1,157	1,025	1,163	726
Koulikoro	590	545	189	-	448
Sikasso	1,084	888	507	1,037	688
Ségou	2,167	1,566	847	1,342	1,010
Mopti	1,726	826	1,102	394	839
Tombouctou	778	217	1,471	-	506
Gao	474	-	980	-	-

Source: *Enquete Agricole de Conjoncture*, Campagne 1990-1991, Résultats Définitifs, Juillet 1991, DNSI et DNA (Tableau NA-8).

3.3 Agricultural Land Use Pattern

The utilization of land for strictly farming purposes is low. The acreage of land actually cropped averaged 2.1 million ha representing 12% of total land estimated by the Land Resources Inventory Project (PIRT) at 19.6 million ha or 34.3% of total agricultural land potential (Table 3.7).

Table 3.7. Mali: Land Use Potential

Land Classification	Area (ha)	Percent of Total
Agricultural land	19,599,700	34.3
Agro-pastoral land predominantly used for agriculture	7,189,800	12.6
Agro-pastoral land predominantly used for pastoral purposes	7,182,800	12.6
Pastoral land	18,982,800	33.2
Bushes/pastures	3,993,700	7.0
Flooded lands	213,100	0.3
Total	57,062,000	100.0

Source: Projet d'Inventaire des Ressources Terrestres (PIRT), 1986.

Total agricultural land potential is 57.1 million ha, accounting for roughly 46% of the national territory.

In the 1986/87 cropping season, agricultural land use for crops (except cotton) was as follows:

- 69% of the land under cultivation was planted with millet and sorghum.
- 83% of land under cultivation was planted with the major cereal crops (millet, sorghum, maize, and rice).

- 93% of land under cultivation was planted with the major food crops (millet, sorghum, maize, rice fonio, cowpea, and groundnuts).

3.4 Trend in Agricultural Input Utilization

3.4.1 Fertilizer

The levels of use of the main fertilizer types between 1980 and 1990 are presented in Table 3.8

Table 3.8. **Mali: Fertilizer Consumption, 1980-90**
(metric tons of product)

Year	Total	Cotton Complex	Urea	SSP	DAP	Potassium Sulfate (SOP)
1980	31,774	20,495	7,048	1,855	2,326	50
1985	42,218	23,458	15,412	133	3,166	49
1990	51,007	27,739	20,496	88	2,625	59

Source: DNA Annual Reports.

This table highlights a generally low level of fertilizer utilization in the country as compared with the area planted with the major crops. A steady increase in the level of fertilizer utilization was however noted over the decade under review.

Total fertilizer use increased from 31,774 product tons in 1980 to 51,007 product tons in 1990–over 60% increase. The highest rate of increase was for urea followed by cotton complex. DAP use increased between 1980 and 1985 but decreased during the 1985-90 period. SSP accounts for a small portion of total use and has decreased significantly over time.

3.4.2 Improved Seeds

The seed production network is organized around research for the production of basic seed, undertaken by the improved seed production distribution project (OPSS) for R1 (foundation) seed production and the ODRs for R2 (certified) seed production implemented under contracts with seed producers. A national seeds committee is responsible for production planning, OPSS orientation, and R1 allocation.

Table 3.9 provides some quantitative information on the production of improved seeds by OPSS in recent years.

Table 3.9. Mali: R2 (Certified) Seed Production, 1989-91 (metric tons)

Year	Millet	Sorghum	Maize	Cowpeas	Total
1989	11.72	93.75	13.57	3.96	122.99
1990	34.77	193.67	8.31	5.94	242.69
1991	172.0	317.0	16.0	18.0	523.0

Source: UNDP/FAO/MLI/86/005 Improved Seed Project.

Table 3.10 provides information on varieties, yields, and origins of improved seeds produced in Mali in 1991-92.

Table 3.10. Mali: Species, Varieties, Yields, and Origins of Improved Seeds Produced in 1991-92

Species	Varieties	Yields (t/ha)		Origin
		Average	Maximum	
Millet	MgD3	2.5	3	Mali
	NKK	1	2.5	Mali
	1BV8001	1.5-2	2.5	ICRISAT/ Senegal
	HKP			
	Toromou de Ningani			
	Djiguifa	2	2.5	Sikasso (Mali)
Sorghum	CSM 388	-	2.5	Mali
	Tiemanfing	2.5	3	Mali
	CSM 63	-	2	Mali
	Malesir 84-5	-	2.5	Mali
	CE 151	2	2.3	Senegal
Maize	Tienmentié	3.5	4	
	Tuxpano 1			
	Zamguéréni	2	2.5	Mali
	Kogoni B.	2.5	3	Mali
	Safita 2	3.5	5	CIMMYT
	E 211	1.5	2	Mali
	TZE SRW	3.5	5	IITA
Cowpea	TN 88-63	-	3.5	Niger
	Goum-goum	1-1.5	3	Burkina Faso
	Nibani	1	1-2	Mali
	KN1	1.5	-	Burkina Faso SAFGRAD/IITA
Rice	BG 90-2	5	8	
	C 74	5-5.5		Philippines
	H15-23 DA	-	6	Senegal
	Gambiaka	3 on station without fertilizer	5 on station with fertilizer	
	BH 2	3.5 on station without fertilizer	5 on station with fertilizer	
	Adny 11			
	Dourado précoce	-	-	Brazil
	DM 16	-	3.4	
	Khao Gaew	2.5 on station without fertilizer	4.5 on station with fertilizer	
	IRAT 216			

It is obvious from these data that rainfed crop seed production (millet, sorghum, maize, and cowpea) achieved positive results during the past 3 years. This production is,

however, undertaken within the framework of a single project called "production and distribution of improved seeds of food crops grown under rainfed conditions," which is currently limited to the areas of operation of the five ODRs[8] covering only 650,000 ha of rainfed crops. The exact quantity of rice seeds produced and distributed is not known for lack of monitoring by the institutions involved.

It was estimated that in 1987 the percentage of cultivated area sown with improved and certified seeds was 2.1% for millet, 1.4% for sorghum, and 4.7% for rice.

3.5 Land Tenure System

The land tenure system has two main aspects. Land ownership is legally determined by the State. The State, however, through two main legislative decrees (public property and land tenure code and the forestry code) provides the framework for private individuals or corporate bodies to own land through various provisions (registration, rural or urban concessions, etc.). This official legislation exists side by side with the traditional land tenure laws, which, above all, underscore the inalienability of land and preclude any means of individual appropriation. Indeed, according to the customary laws, the land is always the property of the community, village, lineage, or family that occupied it first. It is administered by the representative of this community, who grants the right of use to all, arbitrates in disputes among farmers, and performs the necessary ritual sacrifices recommended for its possession. The land administrator is also responsible for the other natural resources located on the land. Access to these resources is subject to specific procedures.

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[8]CMDT, OHV, ODIPAC, and OMM.

The lease of a patch of land for farming purposes is subject to the prior authorization of the land administrator and a promise by the applicant not to plant fruit trees and operate beyond the prescribed limits. Generally, the leased patch of land reverts automatically to its owner after being left fallow for 5 years. Access to the land for fruit gathering, wood cutting, grading, and hunting is also free.

These customary and traditional laws, which serve as references in a farming community, are tacitly recognized by the State as long as the State does not need the lands governed by these laws.

3.6 Role of Women In Agriculture

Generally, women in rural areas are not considered as far as decisions relating to farming activities are concerned even though they carry out at least half of the work on farms. Among some ethnic groups such as the Bambaras, women are responsible for farming activities such as sowing, weeding, harvesting and winnowing. Women have virtually permanent, albeit indirect, access (through their husbands) to individual patches of land. This situation confers on them an important economic role in the community.

Among other communities, such as the Bobos, women are excluded to a greater extent from economic and social activities. Although women participate in farming activities on family farms, they undertake few income-generating activities because access to individual patches of farm land is very rare. Women organize themselves mainly to process the harvest obtained from the picking of crops. Thus they remain largely dependent on natural resources. It is only in the handicraft sector that rural women have succeeded in

obtaining some degree of economic autonomy. In rural areas, women with emigrant husbands have heavy responsibilities that lead to a difficult life.

3.7 Constraints To Agriculture

The low productivity of Malian agriculture seems to stem as much from the constraints of the physical environment as from the difficult economic situation.

The physical constraints arise mainly from the deterioration in climatic conditions resulting in irregular, and in some cases, scanty rainfall; soil impoverishment caused by a reduction in the duration of fallow periods and the lack of manuring; and intensification of erosion as a result of drought and deforestation due to the extension of cropped areas.

The economic factors responsible for low agricultural productivity are the general lack of agricultural inputs (insufficiency of varieties of seeds adapted to the various ecological zones), the limited use of fertilizer and agricultural equipment, and the cost of imports which is compounded by haulage expenses due to the country's landlocked situation.

One can also mention the low income of farmers who do not enjoy prices incentives to encourage them to produce more and who have no adequate credit scheme but pay high taxes.

3.8 Cost of Crop Production

Costs of production estimates by the Institut d'Economie Rurale (IER) for selected crops in the 1989-90 cropping season ranged from 50.71 FCFA/kg for millet/sorghum to 108.79 FCFA/kg for groundnut (Table 3.11).

Table 3.11 **Mali: Costs of Production for Selected Crops, 1989-90**

Crops	FCFA/kg
Cotton	95.37
Maize[a]	57.03
Millet/sorghum[b]	50.71
Groundnut	108.79
Millet/sorghum[c]	57.60
Irrigated rice[d]	59.83
Flooded rice[e]	69.88
Flooded rice[f]	67.37

a. In cotton-maize rotation.
b. In cotton-millet/sorghum rotation.
c. In groundnut-millet/sorghum rotation.
d. Office du Niger.
e. Opérations Riz Ségou and Mopti.
f. "Zones diffuses" (DRA-Mopti).

Source: IER.

Production costs consist mainly of cultivation costs and labor cost. Cultivation costs include the costs of seeds, fertilizers, insecticides and herbicides, light farm equipment, animal traction, and maintenance of traction equipment. Labor cost is the daily wage rate of casual labor. This wage rate has remained constant at 600 FCFA/person/day since the 1982-83 cropping season. It should be noted that although this wage rate, although it is higher than the official wage rate, is considered the minimum daily wage rate below which it is not possible to hire manual labor in Mali.

The shares of fertilizer cost in cultivation costs and total production costs per hectare, and of labor costs in total costs per hectare are presented in Table 3.12. It is clear from this table that fertilizer cost accounts for relatively larger shares of cultivation as well as total production costs for cotton and maize than for groundnut and irrigated rice. Further research, additional data, and analysis are needed to evaluate the profitability of farming activities and fertilizer use in prevailing pricing environments.

Table 3.12 **Mali: Fertilizer and Labor Cost Shares in Per Hectare Cost of Production, 1989-90**

Crops[a]	Fertilizer Cost/ Cultivation Cost Per Hectare (%)	Fertilizer Cost/ Production Cost Per Hectare (%)	Labor Cost/ Production Cost Per Hectare (%)
Cotton	43.7	21.3	51.2
Maize	60.8	29.2	52.1
Millet/sorghum	NA	NA	73.9
Groundnut	15.5	5.1	67.3
Millet/sorghum	NA	NA	78.1
Irrigated rice	18.2	11.9	34.7
Flooded rice	NA	NA	49.4
Flooded rice	NA	NA	67.4

a. The explanatory notes on Table 3.11 also apply here.
NA = not available.

Source: IER.

Chapter 4

Fertilizer Sector Development

4.1 Introduction

Mali's economy is predominantly an agricultural economy based on traditional methods of cultivation and farming practices. When population pressures were low, such farming systems were adequate to meet the requirements of food, fiber, and fodder. However, with rising per capita income and increasing population, such methods are inadequate. The shortening of fallow periods does not allow replenishment of nutrients removed from the soils by crop cultivation. To transform its agricultural economy, Mali needs new crop technologies and practices. Because new technologies are nutrient-intensive, it also has to increase its fertilizer use to facilitate the adoption of such technologies.

It was indicated in Chapter 1 that, compared with use levels in many developing countries in Asia, Africa, and Latin America, per hectare fertilizer use levels are rather low in Mali. To understand the factors responsible for such low levels of fertilizer use, this chapter is devoted to an analysis of trends in fertilizer use, imports, and prices as well as marketing and distribution arrangements.

4.2 Data

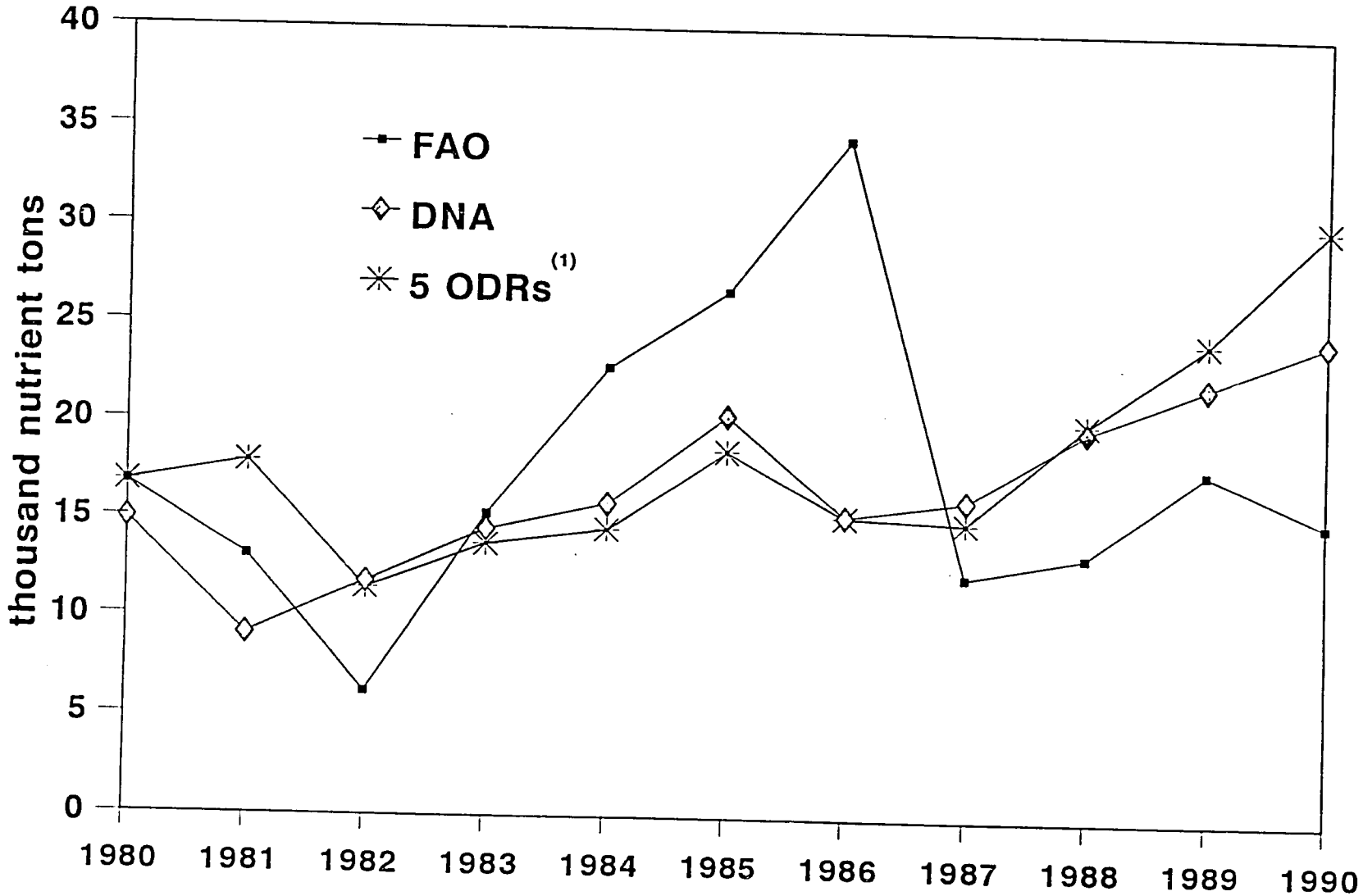
It was indicated in Chapter 1 that reliable and consistent data are not easily available in Mali. Availability of data on fertilizer use from three different sources provides an example of the difficulty, which should be remedied by developing reliable and consistent statistics in future research and capacity-building activities.

Figure 4.1 provides data on fertilizer nutrient use from three sources: FAO, DNA, and five ODRs (CMDT, ON, OHV, ORM, and DRA-M). The differences in the three data series can be explained in part by differences in definitions of fertilizer consumption, differences in methodologies used for collecting data on fertilizer use, and differences in the number of products included in total fertilizer consumption. This section provides some explanations of the differences for each data source.

FAO–In the absence of reliable data, FAO reports data on apparent consumption derived from supply sources. Until recently, the main source of fertilizer supplies was imports. Hence, FAO's data on apparent nutrient use are identical with those for nutrient imports. It is generally assumed that carryover stocks are marginal. However, when stocks are high, FAO data series may produce a distorted picture, especially in the short run. FAO is working on strengthening its ties with field offices to improve its data base.

DNA–The Direction Nationale de l'Agriculture (DNA) is the official source of data on the agricultural sector in Mali. The main sources of fertilizer use data reported by DNA are the annual reports of different rural development operations, such as CMDT, ON, OHV, ORM, DRA-M, ODIMO, ORS, and the Projet Fonds de Développement Villageois, Ségou. Fertilizer deliveries made by nongovernmental organizations, such as CARE International, Save the Children Fund, Catholic Relief Services, and Peace Corps are not included. One explanation for the observed difference between the fertilizer use data reported by DNA and the data obtained from the ODRs is that DNA did not report the use of Tilemsi phosphate rock (TPR) in the past, because TPR accounted for a small proportion of total fertilizer use. In the future, DNA plans to report data on TPR as well.

Figure 4.1 Mali: Fertilizer Use, 1980-90
(thousand nutrient tons)



(1) CMDT, ON, OHV, ORM, and DRA-M
Sources: FAO, DNA Annual Reports, and IFDC / IFPRI / IER Fertilizer Policy Research Project data files.

ODRs–The ODRs selected for regional analysis of fertilizer use are CMDT, ON, OHV, ORM, and DRA-M. Fertilizer use data reported by CMDT, for example, represents quantities placed at the village level for application by farmers in a given cropping season. The ODRs report consumption of both imported fertilizers and domestically produced Tilemsi PR.

It should be noted that there is no clear description of the methodology used for collecting fertilizer consumption data by DNA, DNSI and other agencies in Mali. Efforts are underway to establish a system for providing reliable agricultural sector statistics. The service, called "Diagnostic Permanente" (DIAPER), will operate under the auspices of the Comité Inter-Etats de Lutte Contre la Sécheresse dans le Sahel (CILSS),[9] and will maintain consistent and reliable data on various aspects of agriculture and rural development in Mali.

4.3 Trends in Fertilizer Use

Because of limited time and resources, no attempt was made to resolve inconsistencies in data from various sources. It was decided that data from all three sources should be reported and compared. It was further decided that the DNA data series be used for analyzing national trends and ODR data for discussing ODR trends. In the future, efforts should be made to build a consistent data base system in Mali.

During the 1950s and the 1960s, fertilizer use in Mali was rather low (IFDC, 1976). In 1970, Mali used 2,547 tons of nutrients (Table 4.1). However, during the 1970s, fertilizer use increased rapidly and reached 6,538 nutrient tons in 1975 and 14,928 nutrient tons in

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[9]Interview with IER officials.

1980. The annual growth in fertilizer use during this period was about 17.7% (Table 4.2). It must be stressed that such high annual growth was partly a result of the rather small fertilizer use base in 1970. Nevertheless, fertilizer use increased by about fivefold during the 1970s.

Table 4.1. **Mali: Fertilizer Use, 1970-90** (nutrient tons)

Year	N	P_2O_5	K_2O	Total NPK
1970	693	1,797	57	2,547
1975	2,237	4,301	-	6,538
1980	6,531	5,913	2,484	14,928
1985	10,944	6,641	2,840	20,425
1990	13,784	7,327	3,359	24,470

Source: IFDC (1976) for 1970 and 1975 and DNA for 1980-90.

The annual growth in fertilizer use slowed considerably during the 1980s. Between 1980 and 1990, fertilizer use increased at an annual rate of 4.9% (Table 4.2). In absolute amount, fertilizer use increased from 14,928 nutrient tons in 1980 to 20,425 nutrient tons in 1985 and 24,470 nutrient tons in 1990. Severe droughts of the 1980s were partly responsible for the slowdown in annual growth. However, it must be noted that unlike Ghana, which experienced 7% annual decrease in fertilizer use,[10] Mali maintained an appreciable annual growth in its fertilizer use.

[10]See Bumb et al. (1992) for details.

Table 4.2. Mali: Annual Growth in Fertilizer Use (%)

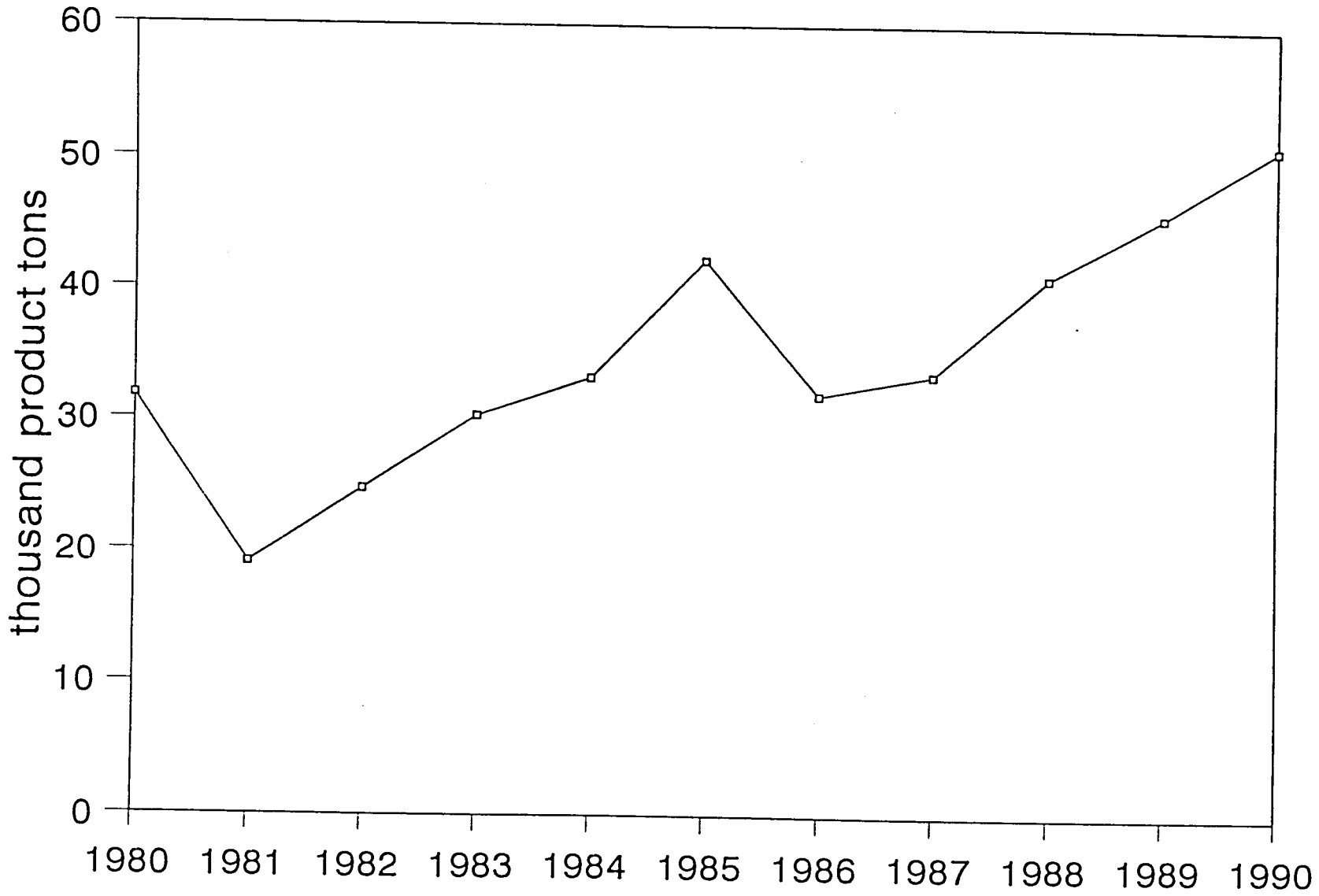
Year	Growth Rate
1970-80	17.7
1980-90	4.9

Although Mali's fertilizer use increased at an average rate of 4.9% per annum, it experienced wide fluctuations in the 1980s (Figures 4.2 and 4.3). Between 1980 and 1981, fertilizer use decreased by about 39%. Likewise, a 25% decrease in fertilizer use was registered between 1985 and 1986. These drops were mostly attributable to severe droughts Mali experienced in the 1980s.

4.3.1 Product Profile

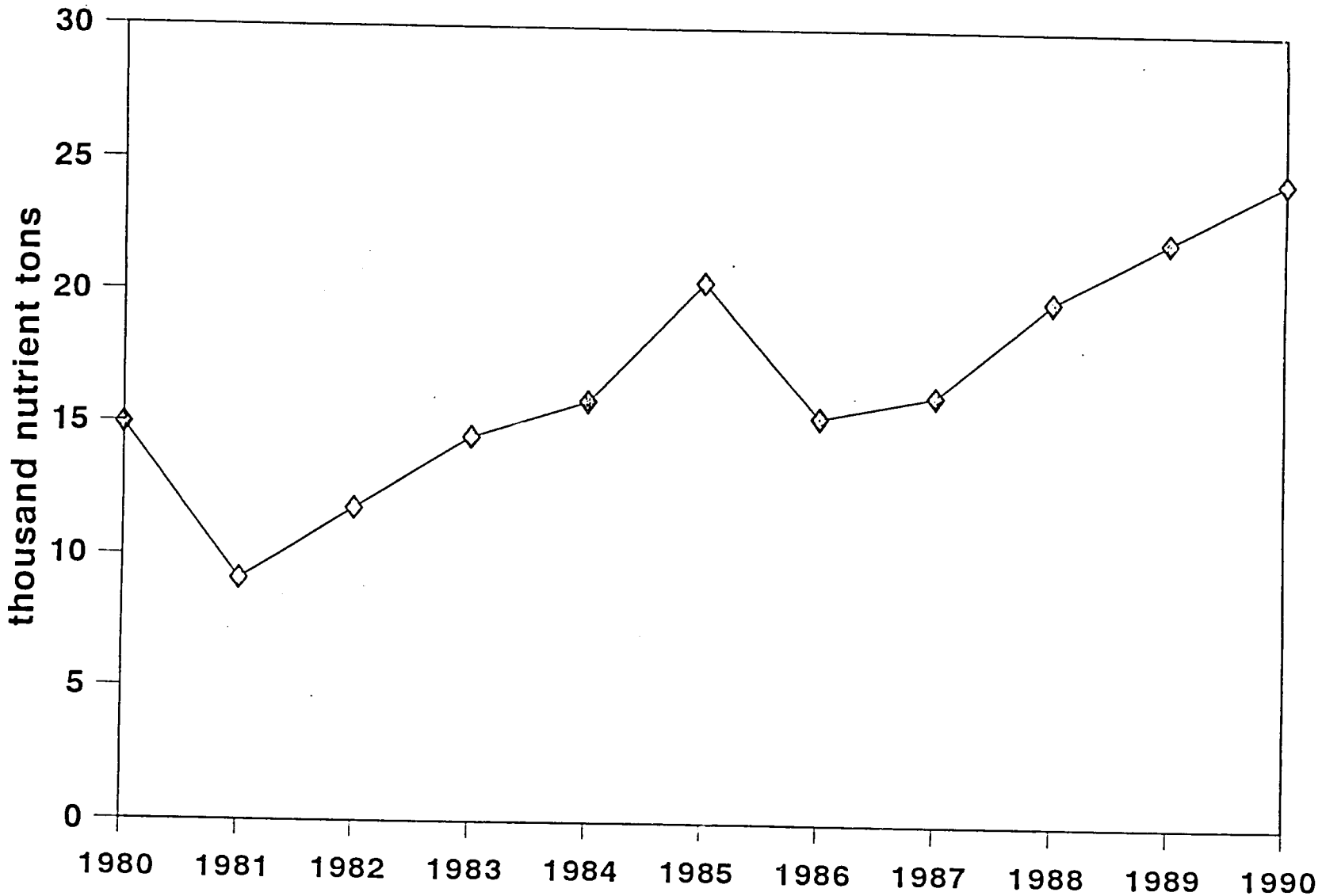
In product terms, Mali's fertilizer use increased from 31,774 product tons in 1980 to 42,218 product tons in 1985 and 51,007 product tons in 1990 (Table 4.3). Thus, there was an annual growth of about 4.7% in product use. The higher growth rate for nutrient use than for product use suggests that the product profile of fertilizer use in Mali was moving in favor of high-analysis fertilizer products. In 1990, urea, DAP, and NPK (14-22-12-7S-1B) accounted for about 99% of total product use in Mali.

Figure 4.2 Mali: Fertilizer Use, 1980-90
(thousand product tons)



Source: DNA.

Figure 4.3 Mali: Fertilizer Use, 1980-90
(thousand nutrient tons)



Source: Computed From D.N.A. data

Table 4.3. Mali: Fertilizer Use By Product, 1980-90 (product tons)

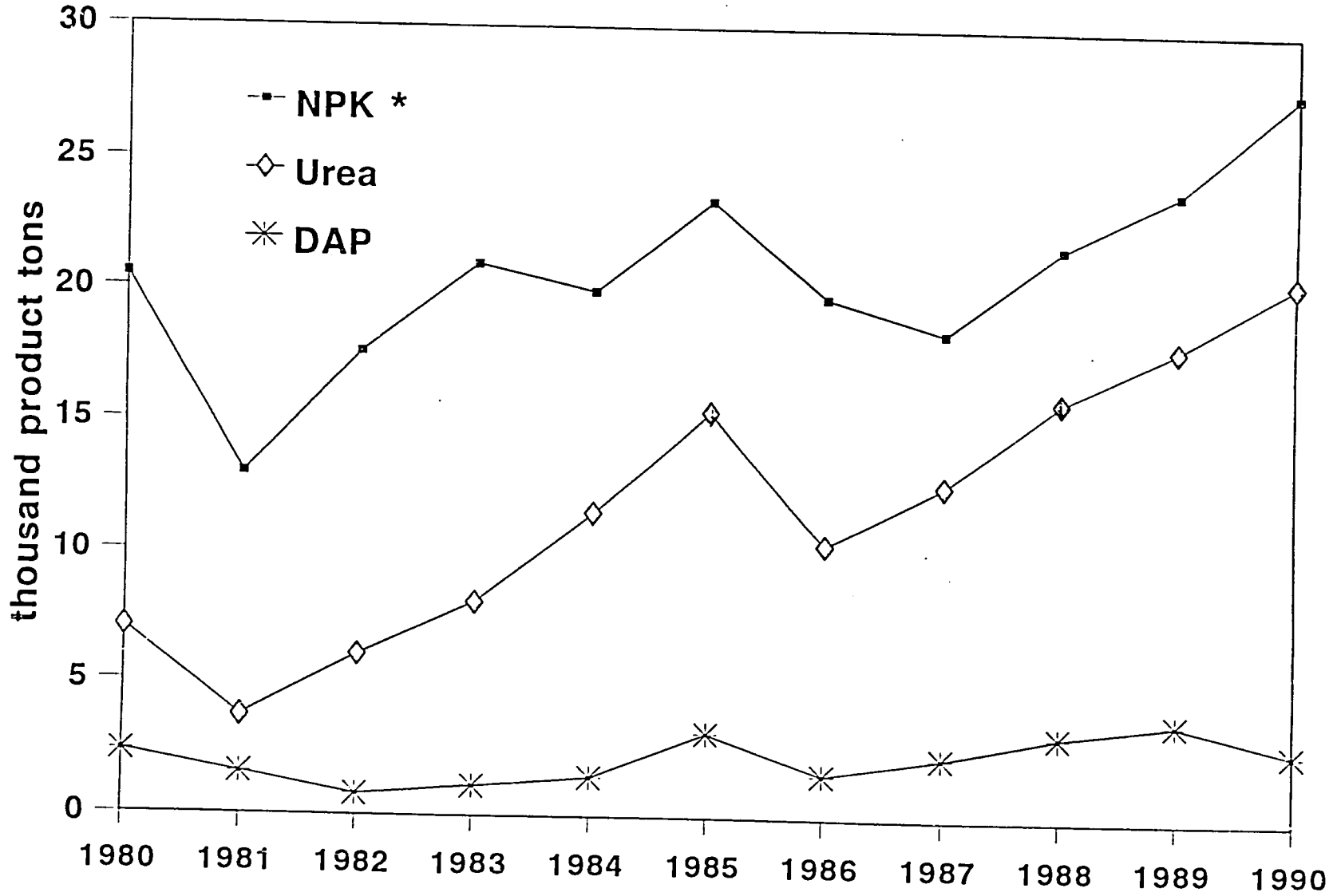
Year	NPK[a]	Urea	DAP	Others	Total
1980	20,495	7,048	2,326	1,905	31,774
1985	23,458	15,412	3,166	182	42,218
1990	27,739	20,496	2,625	147	51,007

a. Cotton complex 14-22-12 (-7S-1B).
Source: DNA.

The consumption of all three products, namely, urea, DAP, and NPK, increased during the 1980s (Figure 4.4). However, each product shows fluctuations induced by both climatic and socioeconomic factors. Fluctuations in nutrient use exhibit a pattern similar to that of product consumption (Figure 4.5).

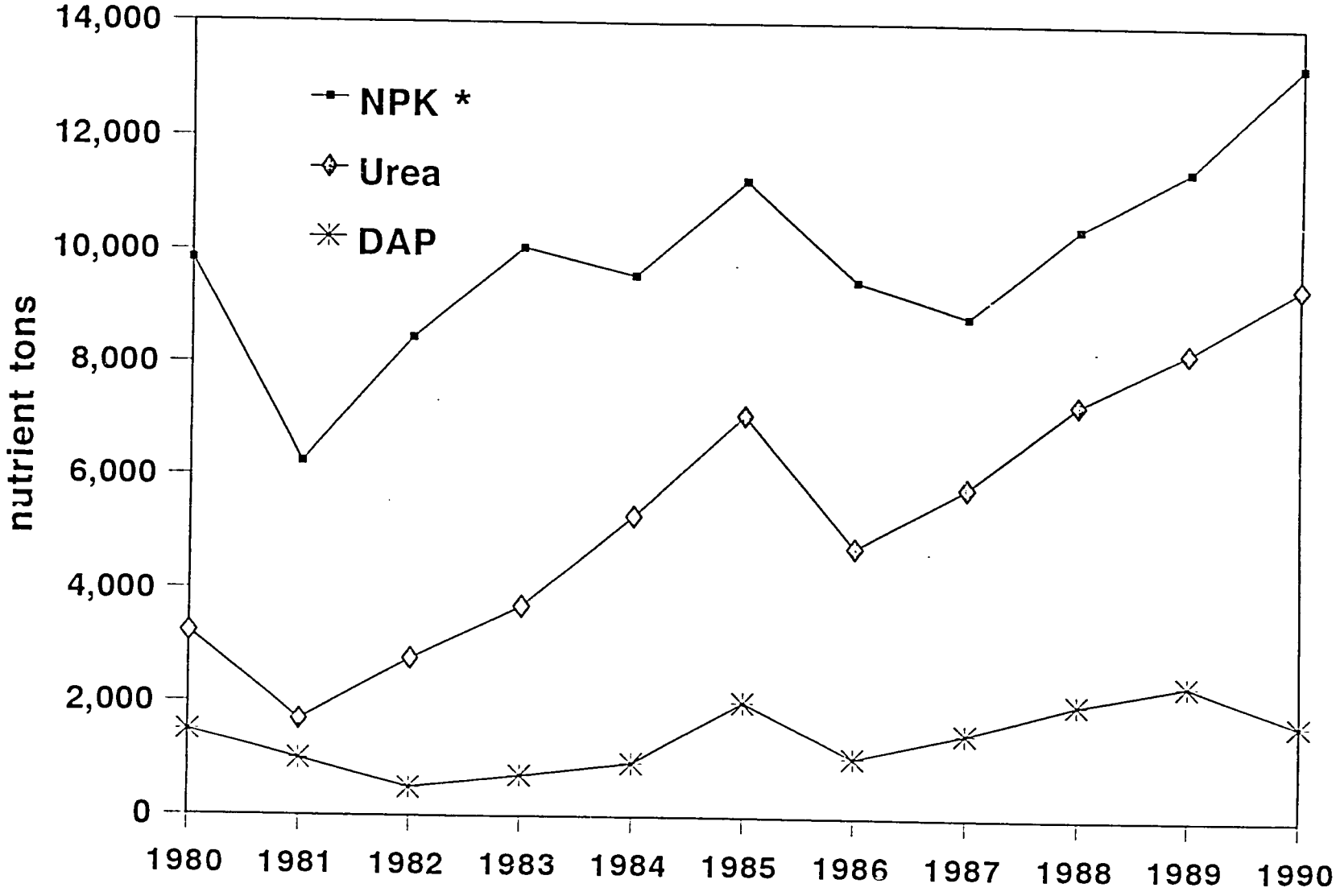
Unlike many other African countries where fertilizer use is dominated by low-analysis fertilizer products, Mali derives its fertilizer nutrients from high-analysis products like urea, DAP, and NPK (cotton complex). These products accounted for over 98% of the total nutrient use during the 1980s (Table 4.4). As a result, the nutrient to product ratio averaged about 48%. In total nutrient use, the share of NPK (cotton complex) has been decreasing. In 1980, NPK and urea accounted for 66% and 22% of total nutrient use, whereas in 1990, their shares were 54% and 39%, respectively. Over time, the share of DAP has also decreased from 10% in 1980 to 7% in 1990. These changes in product shares suggest that fertilizer use in Mali is spreading to food crops although cash crops like cotton and groundnut continue to account for a lion's share of fertilizer use in the country. Increased use of TPR may be partly responsible for a small decrease in DAP's share.

Figure 4.4 Mali: Consumption of Fertilizer Products, 1980-90
(thousand product tons)



* Cotton Complex
Source: DNA

Figure 4.5 Mali: Consumption of Fertilizer Products, 1980-90
(nutrient tons)



* Cotton Complex
Source: DNA.

Table 4.4. Mali: Product Shares in Total Nutrient Use, 1980-90 (%)

Year	NPK[a]	Urea	DAP	Others[b]	Total
1980	66	22	10	2	100
1985	55	35	10	-	100
1990	54	39	7	-	100

a. Cotton complex 14-22-12 (-7S-1B).
b. Includes SSP and SOP.
- = Insignificant.

Source: Derived from DNA data.

4.3.2 Zonal Distribution of Fertilizer Use

Because ODRs are responsible for developing and implementing agricultural and rural development programs, fertilizer use by these ODRs is analyzed below.

Table 4.5 provides data on shares of different ODRs in national fertilizer use. It is clear that in 1980 CMDT accounted for over 70% of the total fertilizer use in Mali. By 1990, CMDT's share increased to 80%. Another major ODR is ON, which accounted for 12%-13%, followed by OHV's share of 4%-5%. Thus, these three ODRs account for over 90% of the total fertilizer use in the country.

Table 4.5. Mali: ODR Shares in National Fertilizer Use, 1980-90 (%)

Year	CMDT	ON	OHV	Others	Total
1980	74	13	5	8	100
1985	80	12	4	4	100
1990	81	13	3	3	100

Source: Derived from DNA data.

Several factors are responsible for CMDT's dominant position. First, CMDT was responsible for growing mostly a cash crop (cotton) for exports. Hence, it developed an integrated management of input and output marketing systems and provided all inputs including fertilizers to the farmers in the project area. It also bought cotton from farmers and thereby ensured a market for their produce. Second, it maintained adequate incentives for fertilizer use. Third, institutional and physical infrastructures were well developed in the project area. Fourth, the CMDT zone is located in the southern part of Mali where soils and climatic conditions are favorable for crop production. Fifth, research and extension support in the zone had been of high quality.

Unlike CMDT, other ODRs are involved mostly in food crops for which price and weather uncertainties introduce relatively higher risks and therefore lower incentives for fertilizer use. Also, the development of physical and institutional infrastructures is inadequate.

Such regional concentration of fertilizer use and the resulting crop output introduce inequities in rural incomes. A conducive policy environment should be able to help in developing a balance in regional development by promoting fertilizer use and developing infrastructures.

4.3.3 Distribution of Fertilizer Use by Crop

There are no time series data on fertilizer use by crop at the national level in Mali. Hence, this section is based on cropwise fertilizer use by CMDT and OHV expressed in terms of number of hectares fertilized with different fertilizer products during 1980-90 (for CMDT) and 1980-89 (for OHV).

One limitation of the CMDT and OHV data is that fertilizer quantities used are not specified by crop. Moreover, in most cases, fertilizer recommendations (for maize, for example) are not followed by farmers.[11] Thus, caution should be exercised in interpreting the data for fertilizer use by crop and by product for CMDT and OHV (Tables 4.6 and 4.7).

Analysis of CMDT data indicates that the cotton area fertilized with the cottoncomplex and urea grew at annual rates of 7.5% and 12.9%, respectively, between 1980 and 1990. The maize area fertilized with the cotton complex and urea grew at annual rates of 16.8% and 18.1%, respectively, between 1980 and 1990, while the fertilized millet/sorghum area grew at 20.1% annually between 1985 and 1990.

Analysis of OHV data indicates that the millet/sorghum area fertilized with urea, DAP, and NPK (from cotton complex) grew at annual rates of 16.4%, 20.9%, and 10.4%, respectively, between 1980 and 1989. However, the millet/sorghum area that was fertilized declined as a share of total area planted to millet/sorghum over the 1980-1989 period. Maize and paddy areas fertilized grew at 7.5% and 16.4%, respectively, for urea and 5.4% and 13.9%, respectively, for DAP, and the maize area fertilized with NPK (from cotton complex) grew at an annual rate of 21.3% between 1980 and 1989. The cotton area fertilized with urea and the cotton complex grew at a rate of 2.2% annually between 1980 and 1989. Area fertilized as a percentage of total area planted with maize, paddy rice, and cotton registered a steady increase over the period. Groundnut was the only crop for which the area fertilized (with SSP) declined at an annual rate of 20.3% between 1980 and 1989.

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[11] See CMDT, *Rapport Annuel, Campagne Agricole, 1988-1989 en Zone Cotonniere*, page 42.

Table 4.6. Area Fertilized by Crop and by Product, CMDT, 1980-90

Crops/Years	Total Area Planted ('000 ha)	Fertilized With Cotton Complex ('000 ha)	Share of Area Planted (%)	Fertilized With Urea ('000 ha)	Share of Area Planted (%)	Fertilized With TPR ('000 ha)	Share of Area Planted (%)
Cotton							
1980	102.0	88.1	86.4	50.1	49.1	NA	-
1985	139.2	126.3	90.7	118.1	84.8	NA	-
1990	194.4	186.5	95.9	181.7	93.5	32.7	16.8
Maize							
1980	24.3	8.9	36.6	7.8	32.1	NA	-
1985	38.2	22.8	62.9	31.0	62.9	NA	-
1990	80.6	47.8	59.3	47.7	59.2	7.8	9.7
Millet/Sorghum							
1980	NA	NA	-	NA	-	NA	-
1985	162.3	5.1	3.1	NA	-	NA	-
1990	298.1	13.9	4.6	13.9	4.6	8.0	2.7
Paddy Rice							
1980	NA	NA	-	NA	-	NA	-
1985	NA	NA	-	NA	-	NA	-
1990	23.2	5.3	23.0	4.6	20.0	0.6	2.6
Groundnuts							
1980	NA	NA	-	NA	-	NA	-
1985	NA	NA	-	NA	-	NA	-
1990	42.3	NA	-	5.2	12.2	1.8	4.3

NA = not available.

Source: CMDT.

Table 4.7. Mali: Area Fertilized by Crop and by Product, OHV, 1980-89

Crops/ Years	Total Area Planted ('000 ha)	Fertilized With Urea (ha)	Share of Area Planted (%)	Fertilized With DAP (ha)	Share of Area Planted (%)	Fertilized With Cotton Complex (ha)	Share of Area Planted (%)	Fertilized With SSP (ha)	Share of Area Planted (%)
Millet/ Sorghum									
1980	20.4	708	3.5	540	2.6	321	1.6	-	-
1984	87.0	403	0.5	501	0.6	NA	-	-	-
1989	112.2	3,105	2.8	3,528	3.1	817	0.7	-	-
Maize									
1980	7.1	408	5.7	312	4.4	47	0.7	-	-
1984	12.8	297	2.3	631	4.9	91	0.7	-	-
1989	11.4	798	7.0	508	4.5	321	2.8	-	-
Paddy Rice									
1980	2.1	93	4.4	114	5.4	NA	-	-	-
1984	3.1	301	9.7	212	6.8	NA	-	-	-
1989	3.7	408	11.0	397	10.7	NA	-	-	-
Cotton									
1980	8.3	8,000	96.0	NA	-	8,000	96.0	-	-
1984	6.2	6,118	98.7	NA	-	6,120	98.7	-	-
1989	9.8	9,777	99.8	NA	-	9,717	99.2	-	-
Groundnut									
1980	8.2	-	-	-	-	-	-	280	3.4
1984	10.3	-	-	-	-	-	-	632	6.1
1989	12.1	-	-	-	-	-	-	45	0.4

NA = not available.

Source: OHV.

These results suggest that the fertilized areas under food crops, particularly maize, millet, and sorghum, in the CMDT and OHV zones are on the increase although the fertilized area for these crops is much smaller than that for cotton. However, the results say nothing about the intensity of fertilizer use on these crops. As food security continues to be a national priority and crop diversification is advocated, these crops will likely account for important shares of fertilizer use in the future. Therefore, further research in this area is needed.

4.3.4 Nutrient Use Intensity

The quantity of fertilizer nutrients applied per hectare of arable land gives an idea of the extent to which fertilizer adoption has taken place in Mali. Table 4.8 presents information on nutrient use per hectare in Mali and in various ODRs. DNA data were used to calculate per hectare nutrient use for Mali, whereas data collected from different ODRs for the IFDC/IFPRI/IER Fertilizer Policy Research Project data files were used to calculate nutrient use per hectare for the ODRs.

Table 4.8. Mali: Nutrient Use Per Hectare, 1980-90 (kg)

Year	Mali	CMDT	ON	OHV	ORM
1980	8.0	59.8	41.2	9.8	5.9
1985	9.3	43.7	43.3	4.9	NA
1990	8.7	41.5	57.6	6.3	0.9

Sources: Calculated on the basis of DNA data (for Mali) and data collected by the IFDC/IFPRI/IER Fertilizer Policy Research Project (for CMDT, ON, OHV, and ORM).

Per hectare nutrient use in Mali increased marginally–from 8.0 kg/ha in 1980 to 8.7 kg/ha in 1990 (Table 4.8). Per hectare nutrient use in CMDT zone decreased between 1980 and 1990. Likewise, nutrient use per hectare declined at an annual rate of 4.4% and 18.8% in the OHV and ORM zones, respectively (Table 4.9). In the OHV zone, nutrient use declined from 9.8 kg/ha in 1980 to 6.3 kg/ha in 1990. A much sharper decline was experienced in the ORM zone where nutrient use fell from 5.9 kg/ha in 1980 to 0.9 kg/ha in 1990. Of the selected ODRs, only ON registered positive annual growth of 3.4%; nutrient use rose from 41.2 kg/ha in 1980 to 57.6 kg/ha in 1990. These trends suggest that growth in fertilizer use in Mali was associated with growth in fertilized area. This issue warrants further research because declining per hectare nutrient use may signify the "mining" of the soils and may pose environmental dangers in the future.

Table 4.9. Mali: Annual Growth in Per Hectare Nutrient Use, 1980-90 (%)

Mali	CMDT	ON	OHV	ORM
0.8	-3.7	3.3	-4.4	-18.8

4.3.5 Direct Application of Tilemsi Phosphate Rock

Although Mali is endowed with deposits of Tilemsi phosphate rock (TPR), containing 31.4% P_2O_5, suitable for direct application (IFDC, 1976), it accounts only for a small proportion of total nutrient use. Furthermore, DNA and ODR data on use of TPR are inconsistent (Table 4.10). For consistency purposes, only DNA data are used in further analysis.

Table 4.10. Mali: TPR Use, 1988-90
(tons)

Year	DNA	ODRs
1988	258	5,743
1989	64	4,110
1990	9,535	11,776

Source: IFDC/IFPRI/IER data files.

The TPR is applied as basal dressing for all crops. Based on DNA data, total consumption of TPR increased from 840 product tons in 1980 to 9,535 product tons in 1990 (Table 4.11). These consumption levels imply an annual growth of 24.3% between 1980 and 1990. Regional shares of TPR consumption over the 1980-90 period are provided in Table 4.12. Office du Niger (ON) was the sole user of TPR in 1980. By 1985, CMDT had become the principal consumer of TPR, accounting for 91%, followed by ODIPAC with 9%. CMDT continued to be a dominant user, accounting for over 98% of total TPR consumption in 1990.

For over 18 months to date, production of TPR has been disrupted because of ethno-political problems in Tombouctou and Gao administrative regions in northern Mali.[12] Stocks of TPR held by CMDT and ON have so far satisfied TPR requirements by farmers in these zones.[13]

Farmers have been slow to accept TPR as an alternative source of phosphorus for, among other reasons, the fact that ground TPR looks like earth and is so dusty that it is

[12]Another region affected by this problem is Kidal, created in 1991.

[13]Interview with Société pour l'Exploitation des Phosphates du Tilemsi (SEPT) officials.

easily lost to the wind during broadcasting. To solve this problem, CMDT advocates mixing the ground TPR with organic manure. To facilitate the adoption of this practice, CMDT has introduced a subsidized credit program that enables eligible farmers to purchase carts for the transportation of organic manure to their farms.[14]

Table 4.11. Mali: Consumption of Tilemsi Phosphate Rock, 1980-90
(product tons)

Year	Total	CMDT	ON	OHV	ODIPAC	Others
1980	840	-	840	-	-	-
1985	2,407	2,187	0	2	208	10
1990	9,535	9,384	127	1	15	8

Source: DNA.

Table 4.12. Regional Shares of TPR Consumption, 1980-90 (%)

Year	CMDT	ON	OHV	ODIPAC	Others	Total
1980	0	100.0	0	0	0	100.0
1985	90.9	0	0.1	8.6	0.4	100.0
1990	98.4	1.3	0	0.2	0.1	100.0

4.4 Trends in Regional Fertilizer Use

Because the ODRs are an integral part of the agricultural and rural development process in Mali, the trends in fertilizer use in some of the selected ODRs are analyzed in detail below.

[14]Discussion with CMDT officials.

Limited availability of time and resources warranted the selection of only five ODRs, namely, CMDT, ON, OHV, ORM, and DRA-M. Because these five ODRs account for more than 95% of the total fertilizer use and cover a wide range of agroecological and socioeconomic conditions, the lessons drawn from their experiences should be able to provide plausible guidance in policy formulation and implementation in Mali.

Table 4.13 and Figures 4.6-4.8 provide information on fertilizer nutrient use in the selected five ODRs during the 1980-90 period. Growth in fertilizer use is shown in Table 4.14. Dominant fertilizer products used by each ODR are presented in Table 4.15.

Table 4.13. **Mali: Regional Fertilizer Use, 1980-90** (Nutrient Tons)

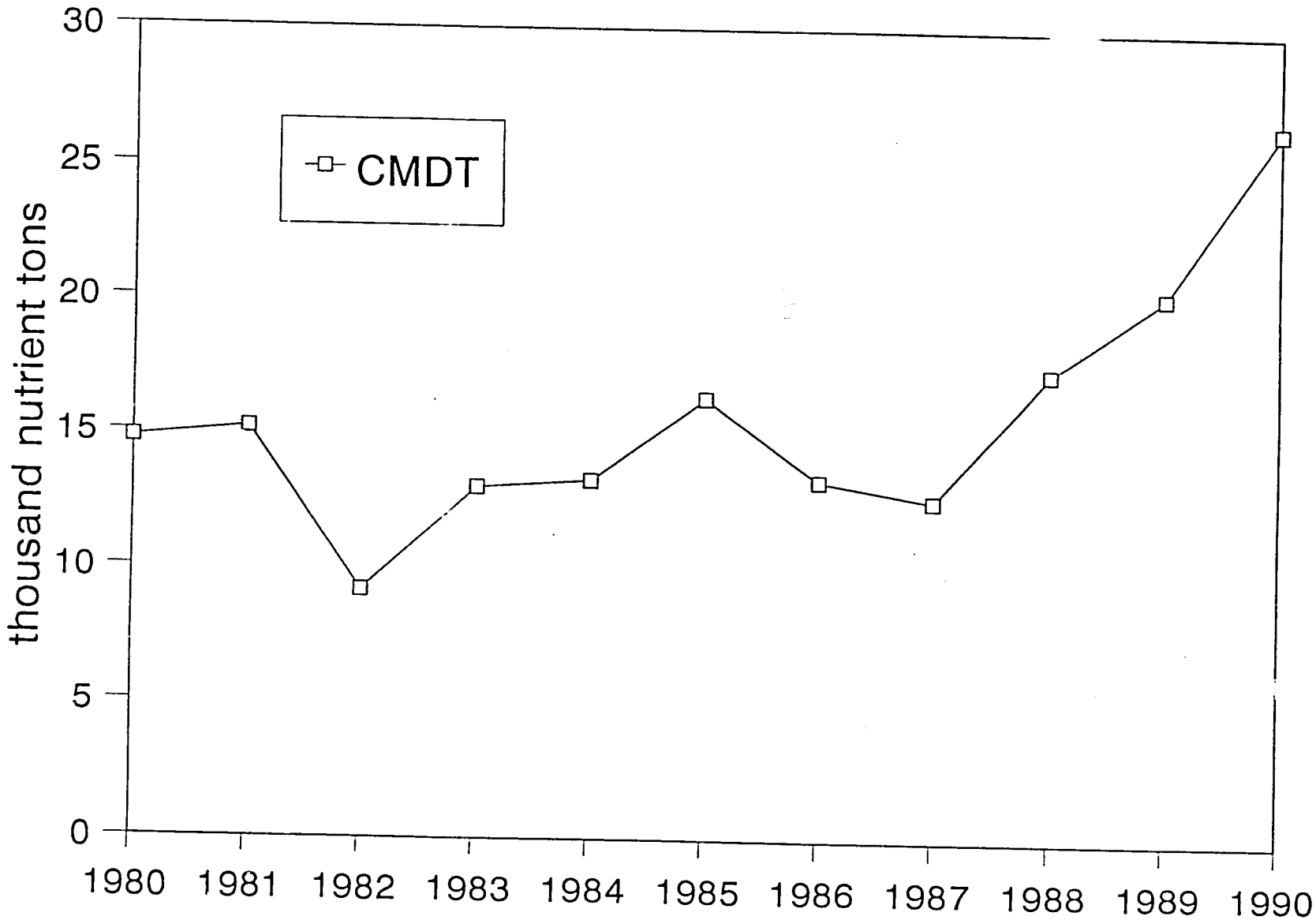
Year	CMDT	ON	OHV	ORM	DRA-M
1980	14,784	1,441	440	88	54
1985	16,338	1,338	604	NA	18
1990	26,504	2,707	1,008	18	11

Source: Computed on the basis of data collected by the IFDC/IFPRI/IER Fertilizer Policy Research Project.

4.4.1 CMDT

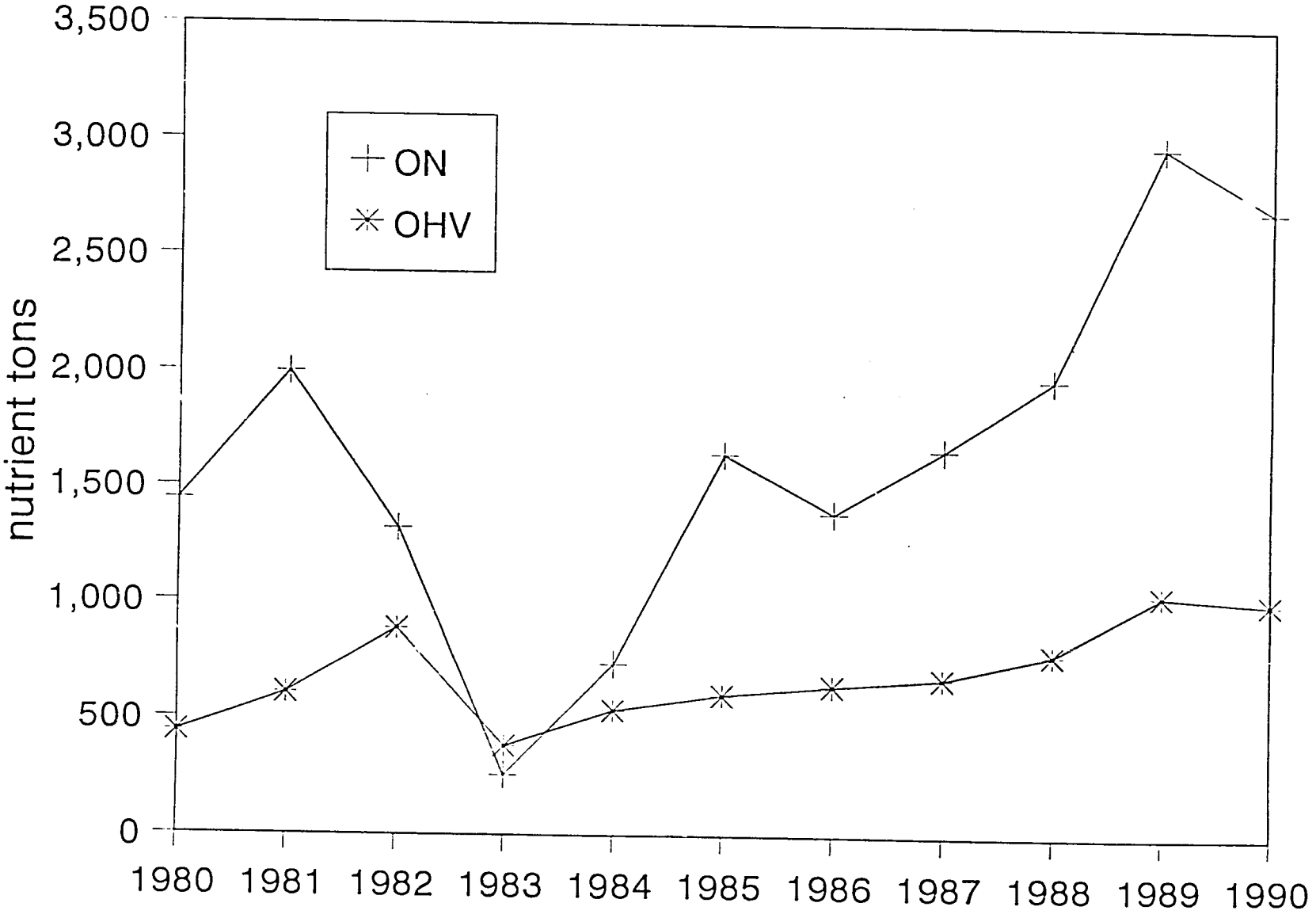
Fertilizer use in the CMDT zone increased from 14,784 nutrient tons in 1980 to 16,338 nutrient tons in 1985 and 26,504 nutrient tons in 1990. In 1981 fertilizer use increased by 2.6% to 15,164 nutrient tons, but it decreased sharply by 39.6% in 1982, reaching its lowest level in the 1980s (Figure 4.6). The sharp decline in fertilizer use in 1982 was due to prolonged drought conditions especially in the northern parts of the CMDT zone. Still because of drought conditions, fertilizer use declined from 16,338 nutrient tons in 1985 to 13,311 nutrient tons in 1986 and 12,609 nutrient tons in 1987. After 1987, however, fertilizer

Figure 4.6 Mali: Fertilizer Use by CMDT, 1)-90
(thousand nutrient tons)



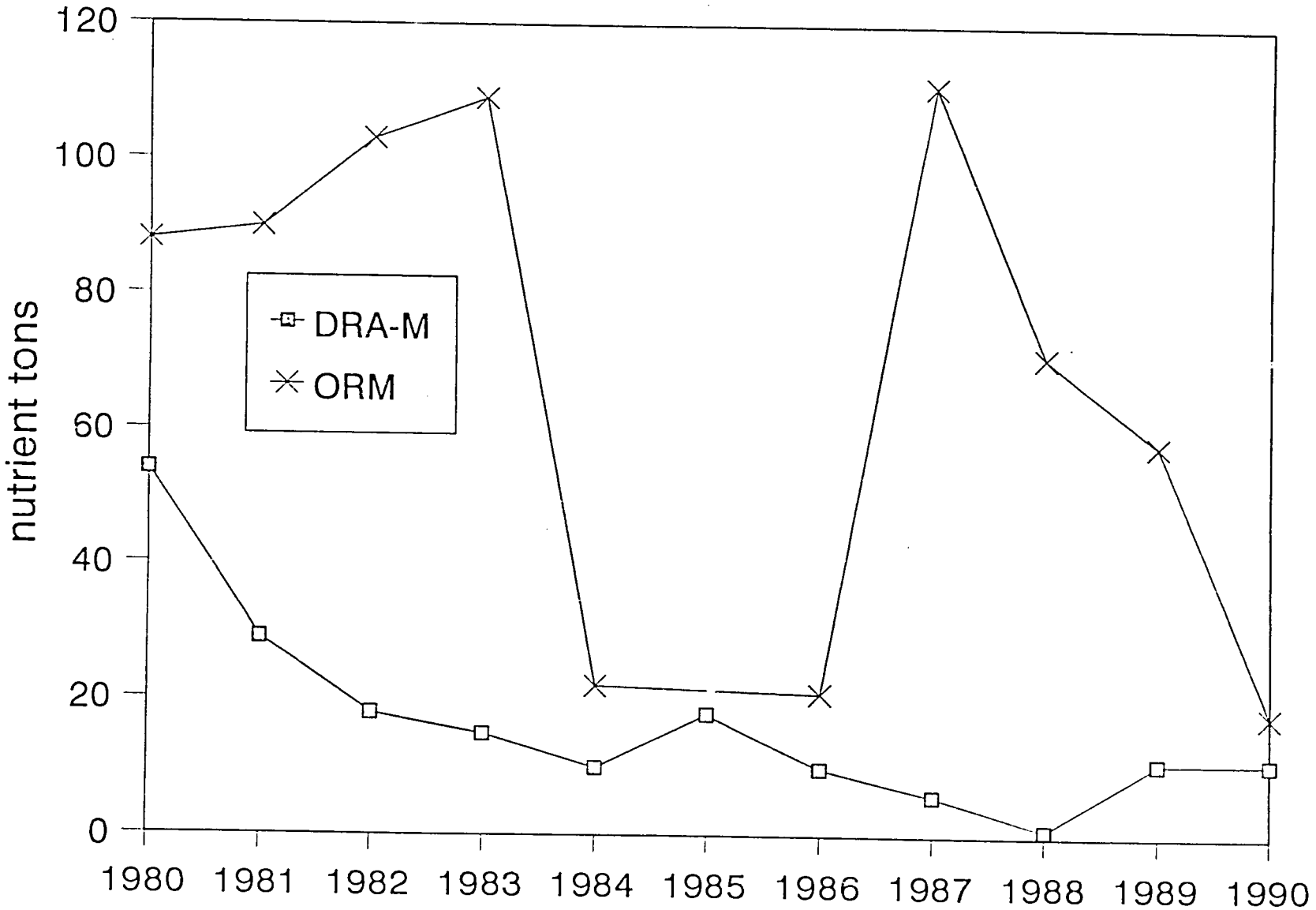
Source: IFDC/IFPRI/IER Fertilizer Policy Research Project Data Files

Figure 4.7 Mali: Fertilizer Use by ON and OHV, 1980-90
(nutrient tons)



Source: IFDC/IFPRI/IER Fertilizer Policy Research Project Data Files.

Figure 4.8 Mali: Fertilizer Use by ORM and DRA-M, 1980-90
(nutrient tons)



Source: IFDC/IFPRI/IER Fertilizer Policy Research Project Data Files

use grew rapidly. Between 1987 and 1990 fertilizer use increased by about 110%. Overall, nutrient use in the CMDT zone grew by 5.8% annually in the 1980s (Table 4.14).

Growth in nutrient use in the CMDT zone during the 1980s was brought about mainly by growth in the consumption of urea and NPK (cotton complex). The consumption of NPK and urea increased from 11,417 and 3,367 nutrient tons in 1980 to 12,719 and 6,986 nutrient tons in 1990. Relatively higher growth in urea consumption implies that fertilizers are increasingly being applied to food crops in the zone.

Table 4.14. **Mali: Growth in Regional Fertilizer Use, 1980-90** (%)

	CMDT	ON	OHV	ORM	DRA-M
1980-90	5.8	6.3	8.3	-15.9	-15.9

4.4.2 ON

In this zone, fertilizer use increased from 1,441 nutrient tons in 1980 to 2,707 nutrient tons in 1990. This represents an annual growth of 6.3% between 1980 and 1990. However, in 1983, fertilizer use dropped to a low level of 257 nutrient tons (Figure 4.7). It was not until 1985 that the use level of 1980 was surpassed. During the 1988-90 period, this zone experienced the highest levels of nutrient use since 1981 although in 1990 nutrient use declined by 10% from a peak of 2,978 nutrient tons in 1989. Such wide fluctuations in fertilizer use are mostly a result of harsh agroclimatic conditions.

This zone's nutrient use is dependent on urea and DAP. Consumption of both products increased from 992 and 449 nutrient tons in 1980 to 1,574 and 1,093 nutrient tons

in 1990. The wide fluctuations observed in nutrient use are also reflected in product use. Fertilizer use in this zone is mostly geared to food crops.

4.4.3 OHV

Compared with CMDT and ON, this zone uses rather small quantities of fertilizer nutrients, which fluctuated between 381 and 1,039 nutrient tons during the 1980-90 period. Between 1982 and 1983 nutrient use declined by 57%. This sharp drop in nutrient use is attributable to severe drought conditions during the 1983-84 cropping season. In 1984, total nutrient use in this zone was 536 nutrient tons, a 41% increase over its 1983 level. After 1984, nutrient use increased steadily, reaching its highest level of 1,039 nutrient tons in 1989, before dropping by 3% to 1,008 nutrient tons in 1990. Fertilizer use in the OHV zone grew at 8.3% annually in the 1980s.

The major fertilizer products used in this zone are the cotton complex, urea, and DAP. Small quantities of SSP, TPR, and SOP are also used.

4.4.4 ORM and DRA-M

In both of these zones, fertilizer use levels are modest and are marked by wide fluctuations (Figure 4.8). Urea and DAP are commonly used products. Very small quantities of TPR are used occasionally. Agroecological conditions, as well as inadequate extension and marketing arrangements, are responsible for their low and fluctuating levels of fertilizer

use. Fertilizer use in both the ORM and DRA-M zones decreased by 15.9% annually between 1980 and 1990.

Table 4.15. **Mali: Product Profile of Regional Fertilizer Use, 1980 and 1990**

Products	CMDT		ON		OHV		ORM		DRA-M	
	1980	1990	1980	1990	1980	1990	1980	1990	1980	1990
Cotton complex	X	X			X	X				
15-15-15		X								
Urea	X	X	X	X	X	X	X	X	X	X
DAP			X	X	X	X	X	X	X	X
Tilemsi PR		X	X	X		X				X
SSP					X	X				
SOP					X	X				
TSP							X			

4.5 Trends in Fertilizer Imports

Mali depends heavily on imports to meet its fertilizer needs. Even so, it should be noted that there is no national time-series on fertilizer imports. However, the quantities imported vary according to agricultural seasons in that imports are based on the needs

expressed by the ODRs, which assist farmers. While the evolution of fertilizer imports in Mali has gone through two phases–the Société de Crédit Agricole et Equipment Rural (SCAER) period and the post-SCAER period, it is important to note two important aspects of fertilizer imports during the SCAER period. First, the Malian Government has never defined a fertilizer import policy with the support of a specific budget. Second, it is almost impossible to get adequate information regarding the amount of money spent annually on fertilizer imports because SCAER used to import fertilizers, other agricultural chemicals, and farming equipment simultaneously for the ODRs.

Until its dissolution in 1980, the SCAER was the parastatal agency responsible for importing fertilizers and other agricultural inputs. The ODRs estimated the pre-season fertilizer requirements of farmers in their zones of operation. These fertilizer requirements were then submitted by each ODR to SCAER for fertilizer orders to be made. The increasing unsustainable fiscal burden caused by SCAER led to its dissolution in 1980. Since then, the most financially viable ODRs–CMDT and ON–are the only two ODRs authorized [illegible] national markets.

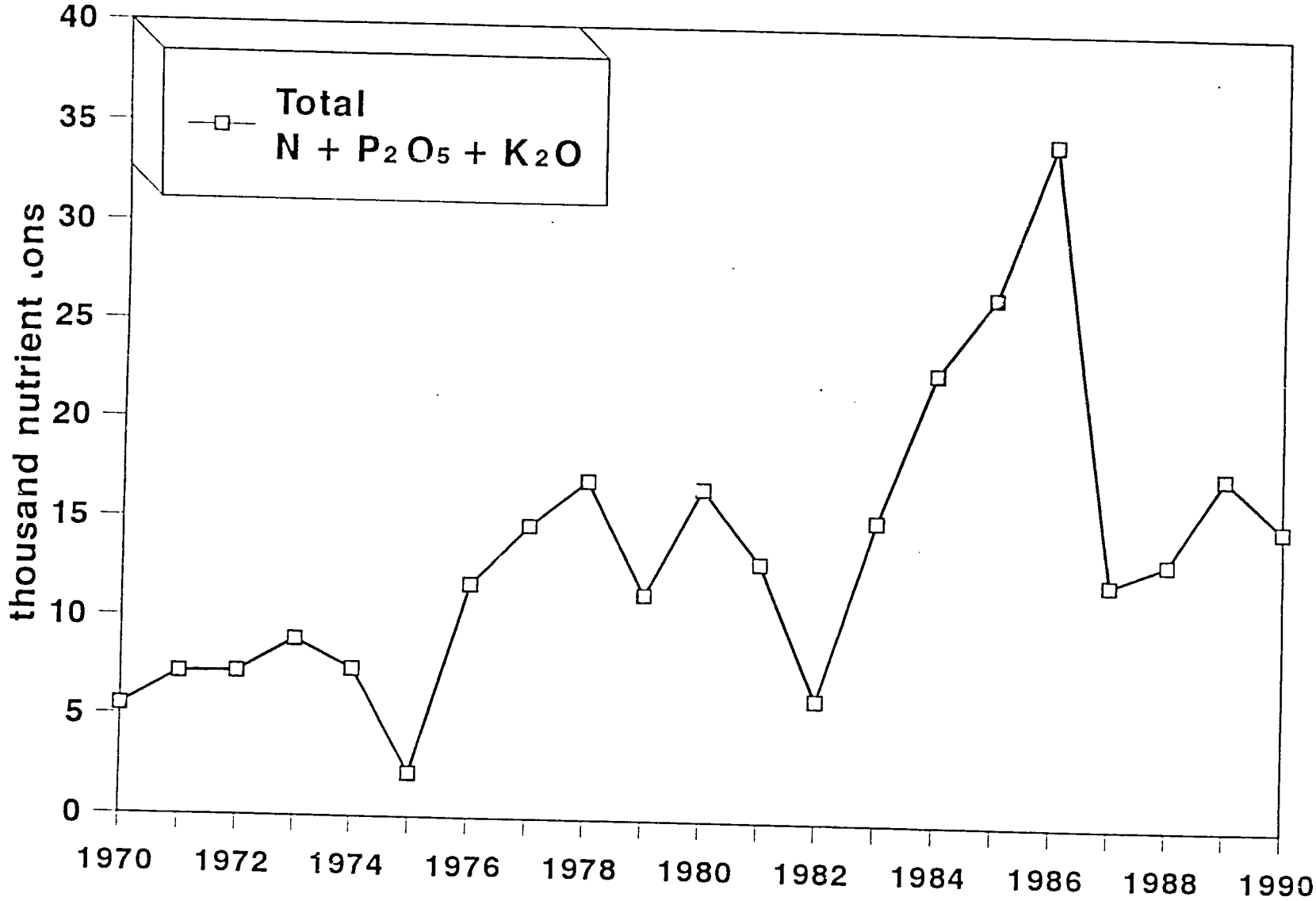
At the Office du Niger, supplies of fertilizer and pesticides are assured in two ways. Fertilizer and pesticide requirements are bought either by ON's Purchasing Department and then distributed to different sectors and Village Associations (AV), or they are purchased directly from fertilizer dealers by the AV. In the specific case of fertilizers, farmers sometimes prefer to purchase directly from the local market, thereby guaranteeing a delivery date consistent with their agricultural calendar. This approach, however, has the disadvantage that all purchases are made in cash. Generally, fertilizer orders are often met through national or international bidding.

In 1991, about 90% of fertilizers imported in Mali came from SENCHIM in Senegal. The Comptoir Malienne de Distribution (COMADIS), a private agricultural inputs importer/distributor handles most of the imported fertilizers. According to Mr. Haidara, the late Managing Director of COMADIS in M'bao, Senegal, COMADIS prefers importing from SENCHIM because it takes 8-10 days for orders to be delivered from Dakar, whereas it takes over three months from Europe.[15]

Until 1970, Mali imported less than 2,000 nutrient tons on average annually. In 1970, Mali's fertilizer imports reached 5,500 nutrient tons (Figure 4.9). Thereafter, Mali's fertilizer imports increased steadily and reached 8,917 nutrient tons in 1973. In 19 4, fertilizer imports declined by 16.5% to 7,442 nutrient tons, and in 1975 fertilizer imports dropped to their lowest level in the 1970-90 period. Imports of fertilizer fell from 7,442 nutrient tons in 1974 to 2,200 nutrient tons in 1975, a 70.4% decline. In 1976, Mali's fertilizer imports increased by 436% over its 1975 level and increased steadily thereafter until 1979 when they fell to 11,400 nutrient tons, then rose by 47.4% to 16,800 nutrient tons in 1980. Overall, Mali's fertilizer imports increased by 11.2% per annum between 1970 and 1980 (Table 4.16). Fluctuations in Mali's total imports during the 1970-90 period reflect fluctuations in the imports of individual nutrients (Figure 4.10).

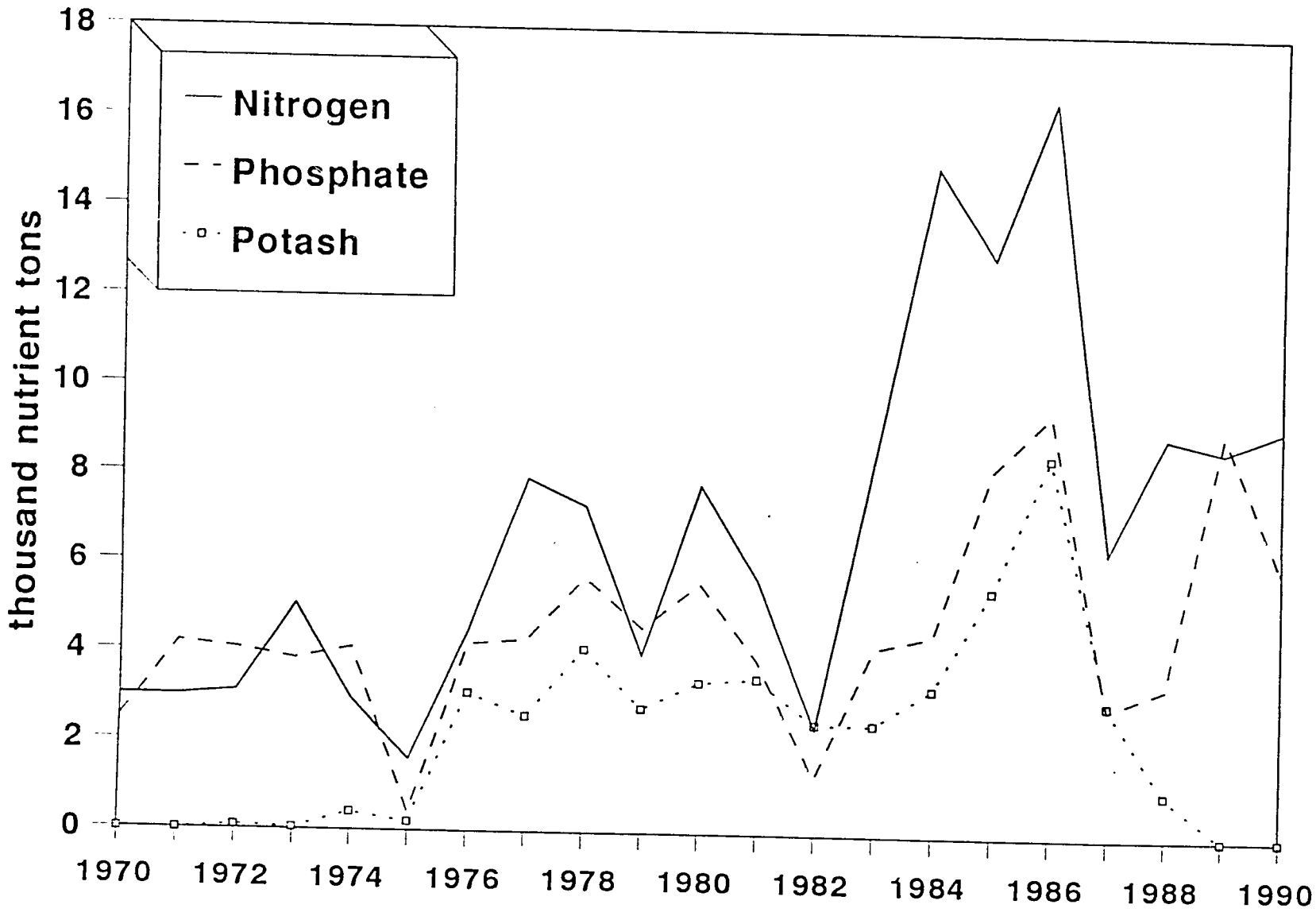
[15] This information is based on a video cassette on COMADIS in 1991.

Figure 4.9 Mali: Fertilizer Imports, 1970-90.
(thousand nutrient tons)



Source: FAO

Figure 4.10 Mali: Nitrogen, Phosphate, and Potash Imports, 1970-90.
(thousand nutrient tons)



Source: FAO.

Table 4.16. Mali: Annual Growth in Fertilizer Imports, 1970-90 (%)

Period	Nitrogen	Phosphate	Potash	Total
1970-80	9.6	8.1	37.1[a]	11.2
1980-90	1.7	0.7	-15.3[b]	-1.0

a. Annual growth rate between 1972 and 1980; no imports of potash in 1970 and 1971.
b. Annual growth rate between 1980 and 1988; no imports of potash in 1989 and 1990.

Source: Derived from FAO data.

Between 1978 and 1984, Mali's fertilizer imports fluctuated widely and reached the lowest level in the 1980s (6,200 nutrient tons) in 1982, a decrease of 52.7% from 13,100 nutrient tons imported in 1981. In 1983, fertilizer imports rose by 147% to reach 15,300 nutrient tons. The sharp drops in fertilizer imports in 1975 and 1982 can be explained mainly by the severe drought conditions experienced in these years.

Between 1980 and 1990 fertilizer imports declined by 1.0% per annum. Fertilizer imports in the 1980s climaxed in 1985 and dropped sharply in 1986. Thereafter, there was a modest recovery. Imports of N, P_2O_5, and K_2O also reveal a pattern similar to that of total NPK imports.

4.5.1 Fertilizer Imports by ODRs[16]

Information on fertilizer imports by other ODRs was not available; hence only CMDT's fertilizer imports are analyzed below. After the dissolution of SCAER, CMDT

[16]Discussions with CMDT staff revealed that CMDT is unaware of the fact that Nigeria produces urea.

started importing fertilizers to meet its own requirements. In 1980, total fertilizer imports by CMDT amounted to 11,707 nutrient tons (Figure 4.11). Between 1980 and 1982, CMDT fertilizer imports fluctuated within a narrow range, and in 1983 fertilizer imports fell sharply to 4,296 nutrient tons from 10,862 nutrient tons imported in 1982. This 60.4% drop in nutrient imports was followed in 1984 by a 240% increase. The sharp drop in fertilizer imports in 1983 was due largely to severe drought conditions experienced in the country.

After 1984, CMDT fertilizer imports accelerated and reached 23,871 nutrient tons in 1986, dropped to 15,351 nutrient tons in 1987, 11,515 nutrient tons in 1988, then rebounded to 16,988 nutrient tons in 1989 and reached its highest level in the 1980s (25,144 nutrient tons) in 1990. Overall, CMDT fertilizer imports in the 1980s grew at 7.6% annually.

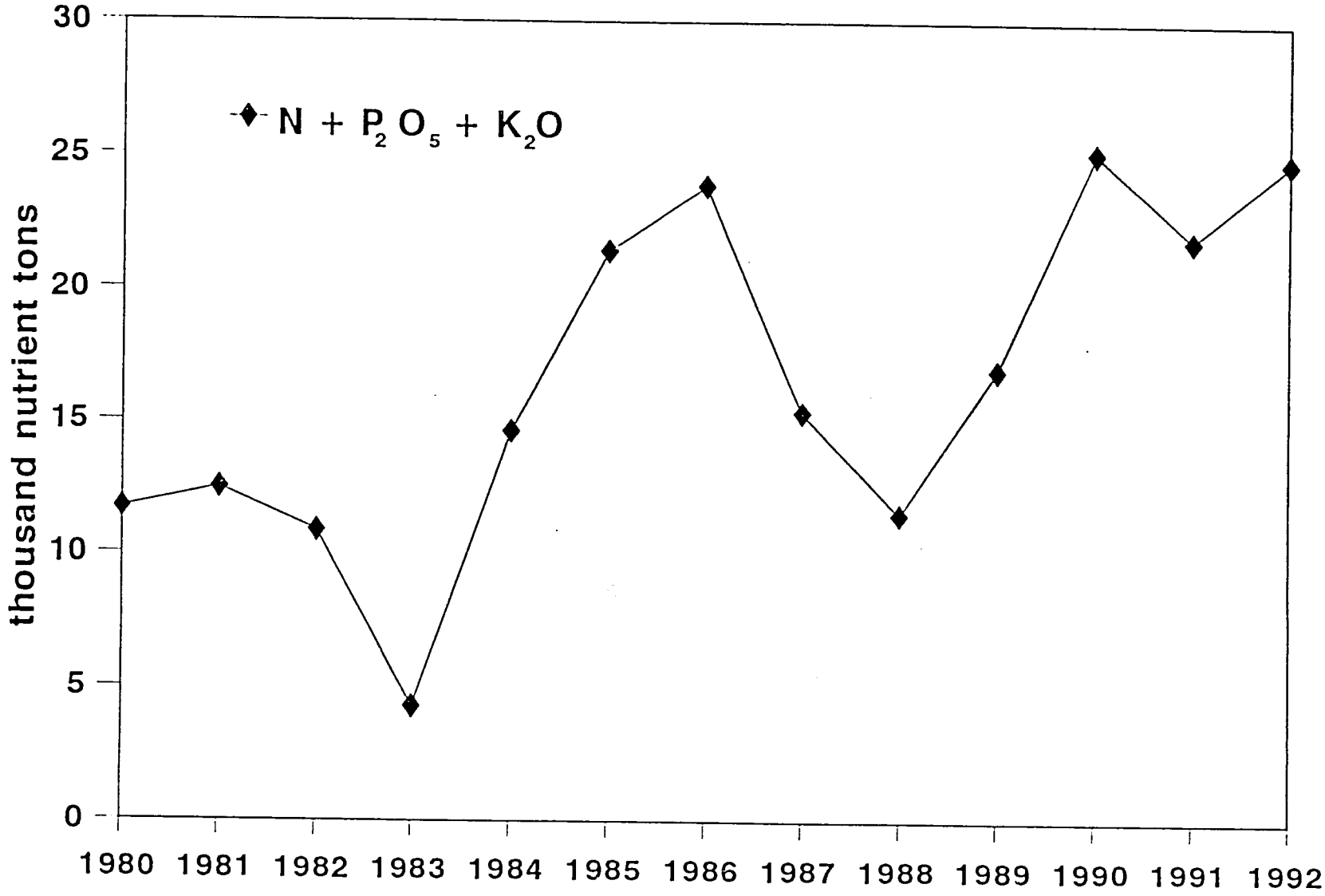
Since 1984, CMDT has imported its fertilizers from three main sources: SENCHIM in Senegal (cotton complex and 15-15-15), SIVENG (now Hydrochem) in Abidjan, Côte d'Ivoire, and Europe (urea).

4.6 Fertilizer Aid

The principal source of fertilizer aid to Mali has been the Netherlands. Other sources of fertilizer aid have included Japan, the Republic of Germany, and nongovernmental organizations (NGOs) such as CARE International, Save the Children Fund, and Catholic Relief Services. However, data on fertilizer aid by Japan, Germany, and NGOs are not available.

Fertilizer aid from the Dutch Government has been channeled directly to the Government of Mali for the purpose of alleviating the country's balance of payments difficulties. The Government then transfers the fertilizer aid to CMDT to sell to its farmers

Figure 4.11 Mali: Fertilizer Imports by CMDT, 1980-92.
(thousand nutrient tons)



at CMDT-determined prices (beginning from the 1990/91 cropping season). Table 4.17 provides information on Dutch fertilizer aid and the ratio of fertilizer aid to fertilizer imports by CMDT for the 1985-90 period.

Table 4.17. Mali: Ratio of Dutch Fertilizer Aid to Fertilizer Imports by CMDT, 1985-90

Year	Imports (1) (Product Tons)	Dutch Aid (2) (Product Tons)	Ratio (%) (2)/(1)
1985	40,599	4,399	11
1988	25,039	21,646	86
1990	53,823	29,410	55

Source: CMDT.

In 1985 Dutch fertilizer aid transferred to CMDT amounted to 4,399 product tons, or 11% of total fertilizer imports by CMDT in that year. In 1988 Dutch aid increased significantly, amounting to 21,646 product tons, or 86% of total CMDT fertilizer imports. In 1990 Dutch fertilizer aid transferred to CMDT reached its highest level of 29,410 product tons and accounted for 55% of total CMDT fertilizer imports. Overall, Dutch fertilizer aid received by CMDT grew at 38% annually between 1985 and 1990. Table 4.18 provides information on the monetary value of Dutch fertilizer aid received by CMDT during the 1985/86-1990/91 period.

Table 4.18. Mali: Value of Dutch Fertilizer Aid Received by CMDT, 1985/86-1990/91

Year	Value of Aid (Million DFL)[a]
1985/86	15
1988/89	15
1989/90	15
1990/91	22

a. DFL = Dutch Florin.
Note: No aid was received in 1986/87 and 1987/88.

Source: CMDT.

4.6.1 Conditions on Fertilizer Aid

The conditions associated with Dutch fertilizer aid to Mali are as follows:

1. CMDT has to pay one-third of the proceeds from the sale of aid fertilizers into the Government treasury for financing public services.
2. In seeking counterpart funds from the Dutch Government, CMDT has to have a rural development project to implement, for example, construction of small dams and provision of short-term credit to farmers for the purchase of light farm equipment and implements.
3. Two-thirds of the proceeds from sale of aid fertilizers must be devoted to rural development projects.

4.7 Fertilizer Marketing and Distribution

Efficient marketing and distribution of fertilizers can have important implications for fertilizer use in Mali. During the SCAER period, fertilizers were imported solely by SCAER, but marketing and distribution functions were undertaken by ODRs (such as CMDT, ON, and ODIPAC) on behalf of SCAER. Currently, ODRs still undertake most of the fertilizer marketing and distribution. However, a few private firms, such as UMIMA and COMADIS, also render these services. This section discusses fertilizer marketing and distribution in the CMDT and OHV zones. Information on marketing and distribution in other ODRs was not readily available.

4.7.1 Fertilizer Distribution in CMDT Zone

CMDT has more than 100 service warehouses through which fertilizers, insecticides, herbicides, and seeds are transferred to the village-level warehouses owned and operated by Village Associations. CMDT suppliers, such as SENCHIM in Senegal and SIVENG (now Hydrochem) in Côte d'Ivoire, ensure delivery of fertilizer orders to CMDT warehouses. Once CMDT has moved the fertilizers to the village-level warehouses, the fertilizers are then transferred to farmers on short-term credit lasting one cropping season and repayable when their harvests of cotton and groundnuts are marketed.

4.7.2 Fertilizer Recommendations by CMDT

For farmers to be eligible for various services rendered by ODRs, certain conditions must be fulfilled. One of these conditions is that the farmers should follow the rates of fertilizer application recommended by the ODRs. The CMDT fertilizer recommendations

are summarized in Table 4.19. It should be pointed out that farmers do not always follow these recommendations. This tendency is explained mainly by socioeconomic factors.[17]

Table 4.19. Mali: Recommended Rates of Fertilizer Application in CMDT Zone

Fertilizer Products	Nutrient Content (N-P_2O_5-K_2O-S-B)	Crops	Recommended Dose (kg/ha)	Price[a] in 1990 (FCFA/kg)
Cotton Complex	14-22-12-7-1	Cotton	150	120
Cereal Complex	15-15-15	Maize, Millet/ Sorghum	100 100	NA
Urea	46-0-0	Cotton Rice Maize	50 100 150	100
Tilemsi PR	0-31.4-0	Cotton/ Maize	300[b] 100[b]	30
SSP	0-18/21-0	Groundnut	75	NA

a. FCFA per kilogram of fertilizer product.
b. Tilemsi PR is applied as basal dressing for all crops. CMDT recommends the application of TPR at a rate of 300 kg/ha, applied once for 3 years, *or* 100 kg/ha, applied each year.
NA = not available.

Source: CMDT.

4.7.3 Fertilizer Distribution in OHV Zone

With over 44 service warehouses, OHV has a fertilizer marketing and distribution system similar to that of CMDT. OHV local suppliers ensure that OHV fertilizer orders are delivered at OHV central warehouses; from this point, OHV takes responsibility for delivering the fertilizers to village warehouses managed and operated by Village Associations.

[17] Interview with CMDT officials.

Like CMDT, OHV transfers the fertilizers to farmers on short-term credit for the duration of the cropping season, repayable at harvest time when OHV buys the cotton and groundnut output. However, in the OHV zone farmers have the option of paying cash for their fertilizer purchases.

4.7.4 Fertilizer Recommendations in OHV Zone

Table 4.20 summarizes the fertilizer recommendations that farmers in the OHV zone are required to follow. It must be stressed, however, that these recommendations are not always followed by farmers. As in the CMDT zone, the reasons are based to a large extent on socioeconomic factors.

Table 4.20. **Mali: Recommended Rates of Fertilizer Application in OHV Zone**

Fertilizer Products	Nutrient Content (N-P_2O_5-K_2O-S-B)	Crops	Recommended Dose (kg/ha)	Price[a] in 1990 (FCFA/kg)
DAP	18-46-0	Cereals	100	183
Cotton Complex	12-22-12-7-1	Cotton	100-150	177
Urea	46-0-0	Cotton Cereals	50 50	165
Tilemsi PR	0-31.4-0	All Crops[b]	300	47
SSP	0-18/21-0	Groundnut	75	NA

a. FCFA per kilogram of fertilizer product.
b. Tilemsi PR is applied as basal dressing on all crops.
NA = not available.

Source: OHV.

4.8 Trends in Fertilizer and Crop Prices

Fertilizer use depends on many factors both economic and noneconomic. Notable among them are crop and fertilizer prices, interest and exchange rates, availability of credit and foreign exchange, and agroecological conditions and cropping systems. Of these, crop and fertilizer prices play a lead role in promoting fertilizer use at the farm level because they determine the profitability of fertilizer use. Evidence from many developing countries suggests that an adequate incentive is a must for promoting fertilizer use. If it is not profitable, farmers are unlikely to use fertilizers.

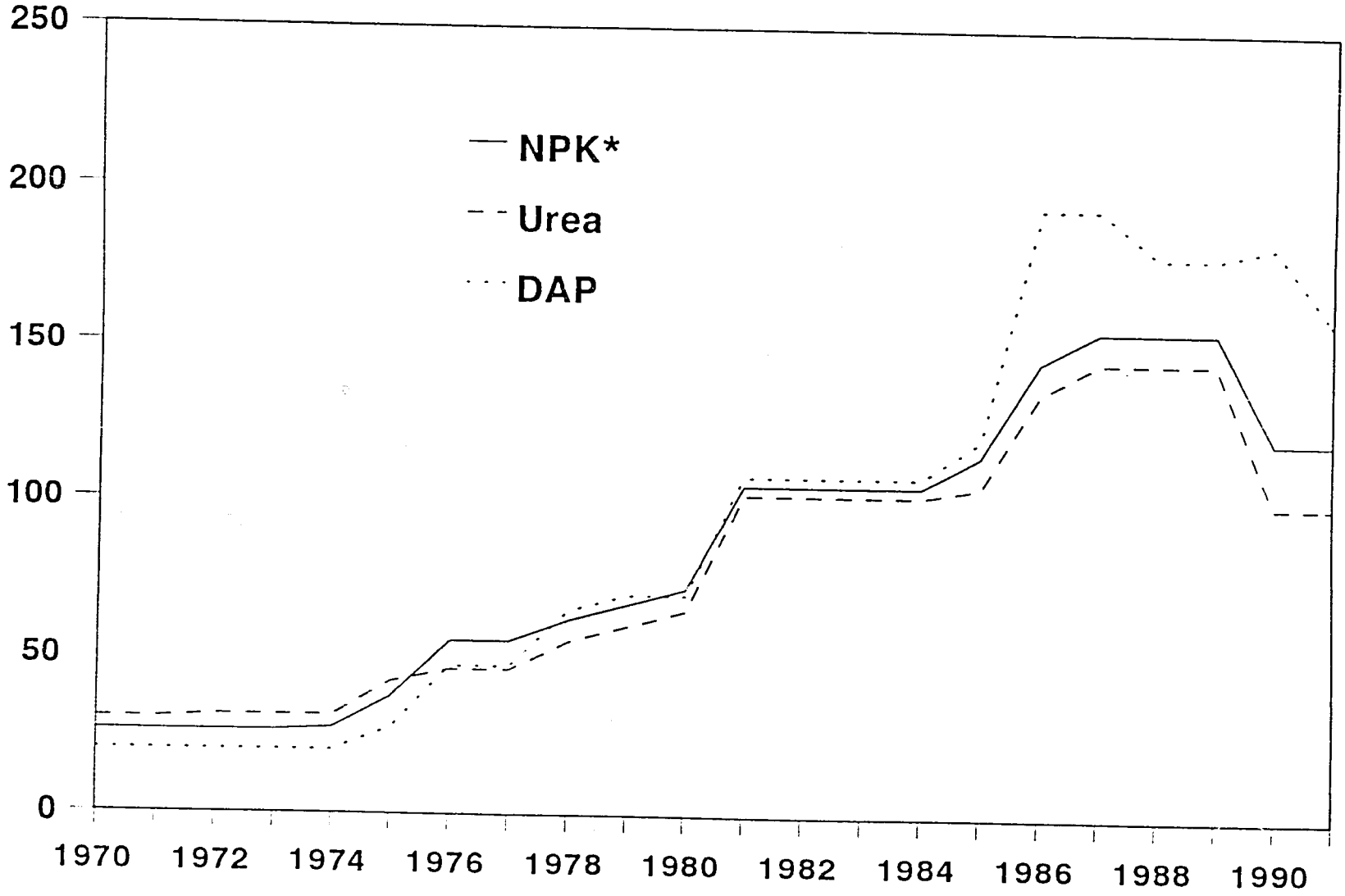
The profitability of fertilizer use depends on three factors: crop response to fertilizer use (technical or agronomic parameters), fertilizer price, and crop price. In order to assess profitability of fertilizer use, trends in crop and fertilizer prices are analyzed in this section. The crop response to fertilizer use is discussed in Chapter 6.

4.8.1 Fertilizer Prices

The trends in fertilizer prices are shown in Figure 4.12. The prices of three fertilizer products, namely, urea, DAP, and NPK (Cotton Complex) during the 1970-90 period are included. Only changes in nominal prices of fertilizer products and nutrients are discussed below. The changes in real prices of fertilizers are analyzed after a brief discussion of changes in crop prices.

The prices of all three products ranged between FCFA 20 and 30 per kilogram during the early 1970s. During the mid-1970s, these prices averaged about FCFA 40/kg. The upward trend in prices continued during the late 1970s as well. Consequently, by 1980, prices of all products were significantly higher than they were in 1970 For example, urea price was FCFA 65/kg in 1980 compared with FCFA 30/kg in 1970. All prices increased by more than 100%.

Figure 4.12 Mali: Fertilizer Product Prices , 1970-91
(FCFA per kg)



Source: DNA
*Cotton Complex

This was a reflection of an increase in world prices (of imported fertilizers) caused by the energy crisis of the mid- and the late-1970s.

In 1981, fertilizer prices further increased by more than 50%. This increase was perhaps a result of measures introduced to reduce subsidy burdens. However, during the next3 years, prices remained unchanged. During that period, prices ranged from FCFA 102/kg to 108/kg for various products. The constancy of fertilizer prices of the early 1980s was followed by several upward adjustments in the mid- and the late-1980s. Consequently, the 1989 prices were 50% higher than those in 1981. After 1989, prices of both cotton complex and urea dropped. However, the price of DAP did not decrease until 1991. This decrease was in response to donor advice to promote fertilizer use for food crops.[18]

Did these price increases have any impact on fertilizer use in the 1980s? This question cannot be answered unless the trends in crop prices are also analyzed because it is the ratio of fertilizer price to crop price (known as the real price of fertilizer) that determines the profitability of fertilizer use. Hence, the trends in crop prices are discussed below.

4.8.2 Crop Prices

Like fertilizer prices, crop prices also show an upward trend during the 1970s and the 1980s (Table 4.21). For example, millet/sorghum price increased from FCFA 9/kg in 1970 to FCFA 35/kg in 1980 and FCFA 55/kg in 1985. Likewise, cotton price also increased from FCFA 25/kg in 1970 to FCFA 85/kg in 1990.

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[18]Interview with CMDT officials.

Table 4.21. Mali: Crop Prices, 1970-90 (FCFA/kg)

Year	Millet/ Sorghum	Maize	Paddy Rice	Groundnut	Cotton
1970	9	10	12	15	25
1975	16	16	20	20	37
1980	35	35	37	40	55
1985	55	55	70	NA	85
1990	46	35	78	72	85

NA = Not Available.

Source: DNA.

Although both crop and fertilizer prices increased during the 1970-90 period, they increased at different rates and therefore it is not possible to determine the profitability of fertilizer use by an analysis of trends in nominal prices alone. To assess their impact on fertilizer use, these nominal prices are converted into real prices (ratios of fertilizer prices to crop prices). Such real prices are presented in Table 4.22.

Table 4.22 is divided into two sections. Table 4.22a provides data on real prices of fertilizer products, and Table 4.22b deals with real prices of fertilizer nutrients.

Table 4.22a. Mali: Real Prices of Fertilizers, 1970-90
(kg of output per kg of fertilizer product)

Year	Urea		DAP		NPK (C. Complex)
	M/S	Rice	M/S	Rice	Cotton
1970	3.3	2.5	2.2	1.7	1.1
1975	2.6	2.1	1.7	1.4	1.0
1980	1.9	1.8	2.0	1.9	1.3
1985	1.9	1.5	2.2	1.7	1.4
1990	2.2	1.3	4.0	2.3	1.4

Source: Calculated using DNA fertilizer product and crop prices.

Table 4.22b. Mali: Real Prices of Fertilizers, 1970-90
(kg of output per kg of nutrients)

Year	Urea		DAP		NPK (C. Complex)
	M/S	Rice	M/S	Rice	Cotton
1970	7.2	5.4	3.4	2.7	2.3
1975	5.7	4.6	2.7	2.2	2.1
1980	4.1	3.9	3.1	3.0	2.7
1985	4.1	3.3	3.4	2.7	2.9
1990	4.8	2.8	6.3	3.6	2.9

During the 1970-85 period, real price of urea decreased by 42% from 3.3 kg of millet/sorghum (per kg of urea) in 1970 to 1.9 kg in 1985. However, after 1985, urea price increased to 2.2 kg. For rice, real price of urea shows a long-term declining trend, thereby making urea cheaper over time. The real prices of DAP decreased in the 1970s and increased

in the 1980s for millet/sorghum but fluctuated for rice. However, for both crops, DAP was costlier in 1990 than it was in 1980. In terms of cotton, the price of cotton complex shows an increasing trend between 1975 and 1990, which means that cotton prices were not keeping pace with fertilizer prices.

In terms of nutrients also, the trends in real prices are similar. The real price of N (through urea) decreased from 7.2 kg of millet/sorghum and 5.4 kg of rice in 1970 to 4.1 kg and 3.3 kg, respectively, in 1985. However, in 1990 the situation changed. The N price increased for millet/sorghum but decreased for rice. The cotton price of fertilizer nutrients increased between 1980 and 1985, but remained constant thereafter. The DAP price decreased in the 1970s but increased in the 1980s for both millet/sorghum and rice.

Thus, except for the N (urea) price for paddy rice, real prices of all nutrients were higher in 1990 than they were in 1980 for all crops.

Among different sources (product) of nutrients for food crops, the nutrient price in 1990 was about 32% higher with DAP than with urea for both millet/sorghum and rice. This may be due to a relatively higher price of phosphate fertilizers contained in DAP.

From this analysis, it can be safely concluded that real prices of fertilizer nutrients have increased significantly during the late 1980s. That means the *relative* profitability of fertilizer use was lower in 1990 than it was in 1980. Whether it was still profitable to use fertilizers on food and cash crops is analyzed in Chapter 6.

4.9. Zonal Differences in Fertilizer Prices

Figures 4.13 and 4.14 provide information on fertilizer product prices in CMDT and OHV zones. It is obvious from these figures that fertilizer prices were higher in the OHV zone than in the CMDT zone. Transportation and distribution costs, as well as the small size of the OHV market, make fertilizer products relatively costlier in the OHV zone.

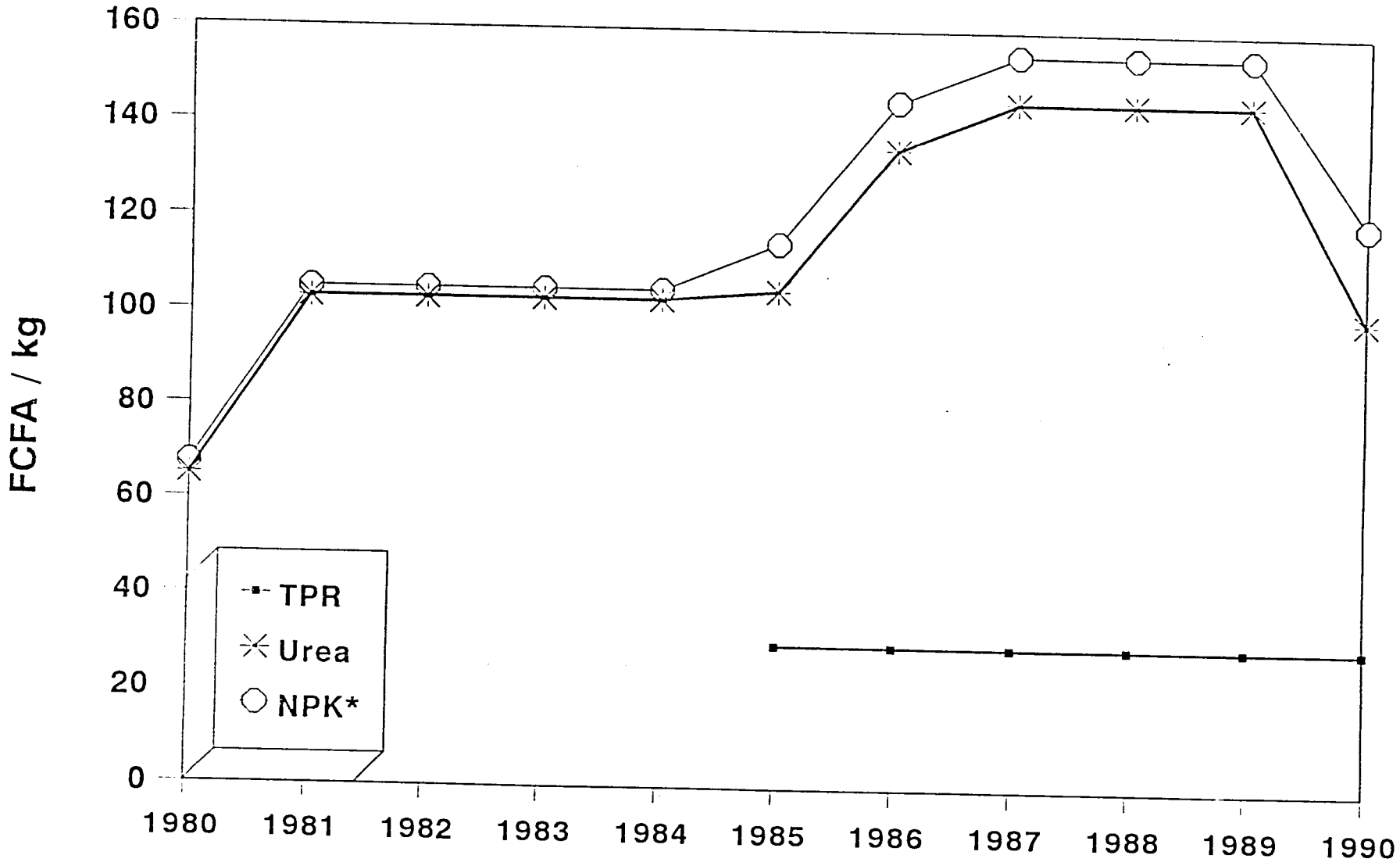
Because the nutrient prices in the OHV zone are much higher than those in the CMDT zone, it is possible that fertilizer use may not be as profitable in the former as it is in the latter. For example, in 1990, a farmer in the OHV zone had to pay 7.8 kg of millet/sorghum to buy 1 kg of N (through urea) as against 4.7 kg by a farmer in the CMDT zone (Table 4.23). In relative terms, nitrogen price was 66% higher in the OHV zone than in the CMDT zone in 1990. Such higher costs of fertilizers may have affected fertilizer use in the OHV zone. This issue is discussed further in Chapter 6.

Table 4.23. **Mali: Real Prices of Fertilizers by Zones, 1990**
(kg of output per kg of nutrients)[a]

Crops	Nitrogen[b]			NPK[c]		
	CMDT	OHV	Ratio[d]	CMDT	OHV	Ratio[d]
Millet/sorghum	4.7	7.8	1.66	5.4	8.0	1.48
Rice	2.8	4.6	1.64	3.2	4.7	1.47
Cotton	2.6	4.2	1.62	2.9	4.3	1.48

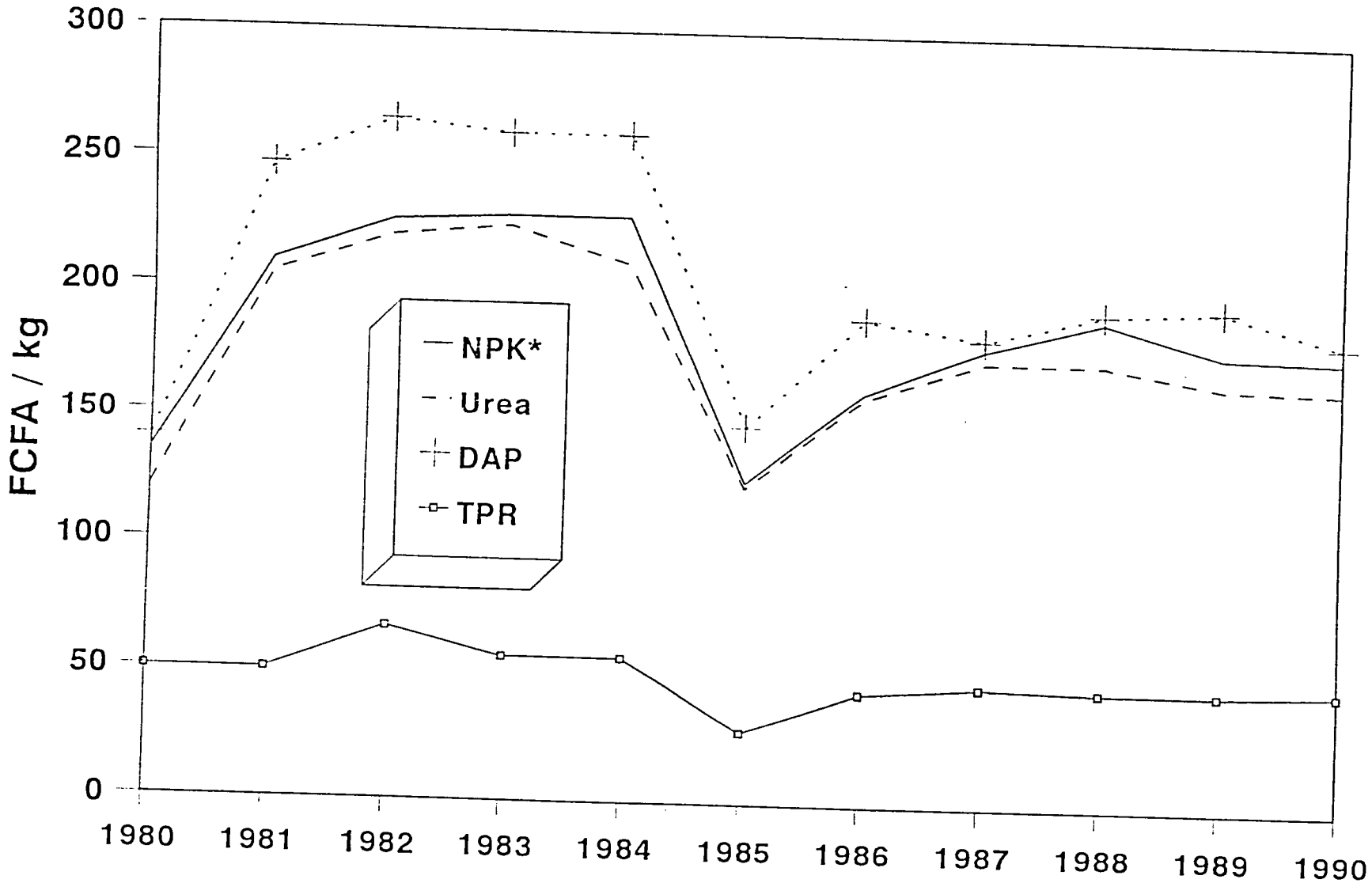
a. Derived by using national crop prices and zonal fertilizer product prices.
b. Based on urea.
c. Based on cotton complex 14-22-12 (-7S-1B).
d. Ratio of OHV to CMDT real fertilizer prices.

Figure 4.13 Mali: Fertilizer Product Prices in CMDT Zone, 1980-90
(FCFA per kg)



Source: CMDT.
*Cotton Complex

Figure 4.14 Mali: Fertilizer Product Prices in OHV Zone, 1980-90
(FCFA per kg)



Source: OHV.
*Cotton Complex

4.10 Constraints on Fertilizer Use

There are various constraints on the use of improved agricultural inputs such as chemical fertilizers. These constraints can, for simplicity of exposition, be classified under four broad headings: agroecological constraints, institutional constraints, infrastructural constraints, and socioeconomic constraints. These constraints are present, albeit to different degrees of severity, in most countries following an agriculture-based development strategy. Agroecological constraints are comprehensively discussed by Henao, Bakary, and Traoré (1992).

Other important constraints to fertilizer use in Mali include socioeconomic constraints arising from the lack of profitability of fertilizer use and constraints due to inadequate extension and marketing services. The case of Tilemsi PR is a special case regarding the constraints posed by ineffective extension services. Widespread adoption of Tilemsi PR can lead to significant savings in financial resources spent on imports of phosphatic fertilizers. However, farmers are reluctant to use TPR for several reasons, including (1) the dusty form in which it is presented to farmers and the propensity to lose it to the wind during broadcasting; (2) the lagged yield response to applied TPR, a characteristic which is unacceptable to subsistence farmers who desire quick and positive net return on their investment; and (3) the fact that TPR contains only phosphorous but the soil needs, in addition to P, other nutrients such as N and K. More effective research and extension services can greatly contribute towards alleviating these constraints on TPR use. Moreover, the policy environment must offer incentives for the small farmer to adopt this technology.

Thus, a major alternative to alleviating the constraints on sustained growth in agricultural production caused by low soil fertility is to create a conducive policy environment.

Chapter 5

The Policy Environment: An Analytical Framework

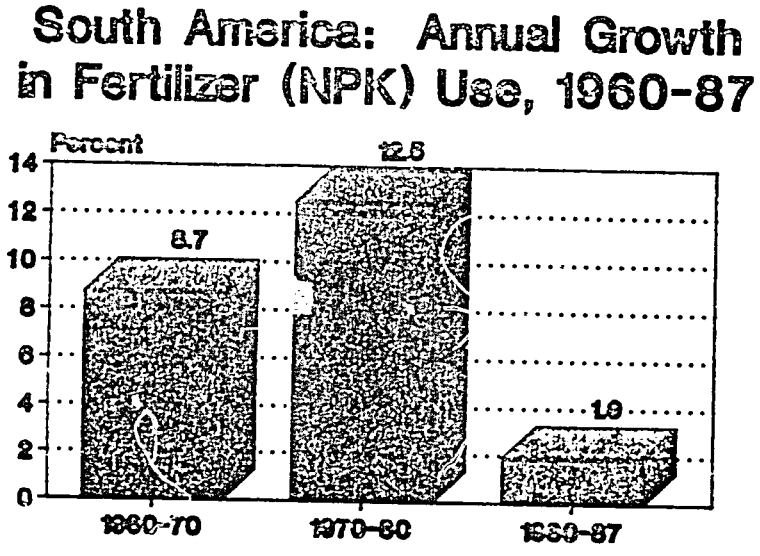
5.1 Introduction

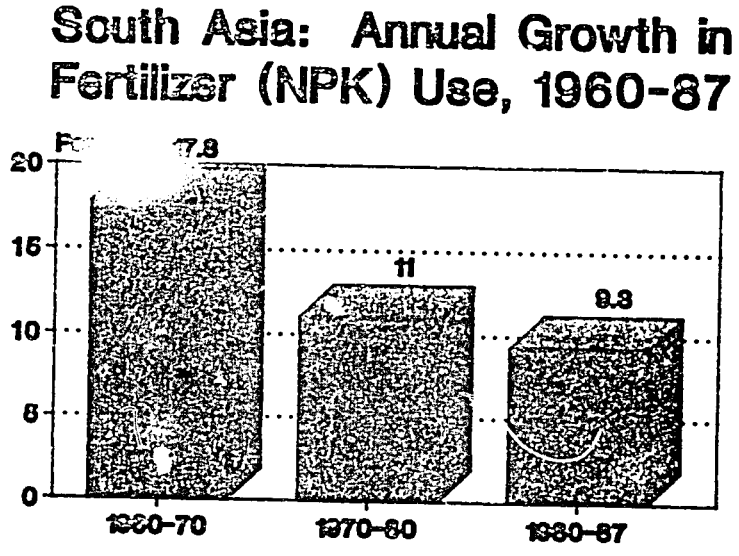
Efficient, equitable, and environmentally safe fertilizer use depends not only on sound agronomic practices and appropriate fertilizer products but also on the existence of a conducive policy environment. Inappropriate policies have resulted in inefficient fertilizer use and environmental degradation and/or loss in crop production and farm incomes in many developing countries. Nonconducive policy environments in many African countries have kept fertilizer use rather low. In other countries, excessive farm subsidies have led to misuse of fertilizer products and environmental pollution. Likewise, poor quality control and environmental standards have created environmental pollution in several locations where fertilizers are produced.

The experiences of South America and South Asia in the 1980s clearly explains the role of conducive and stable policy environment in promoting growth in fertilizer use (Figure 5.1).

In the 1980s, South America experienced several policy shocks–debt crisis, foreign exchange shortages, removal of fertilizer subsidies in Venezuela and subsidized credit in Brazil, and low crop prices for many agricultural export commodities. Consequently, fertilizer use grew by less than 2% per annum as against 12.5% per annum in the 1970s. In contrast, South Asian countries maintained a stable and conducive policy environment for their fertilizer and agricultural sectors. Foreign exchange shortages were not allowed to affect

Figure 5.1


South America: Annual Growth in Fertilizer (NPK) Use, 1960-87
Percent
14
12
10
8
6
4
2
0
8.7
12.5
1.9
1960-70
1970-80
1980-87


South Asia: Annual Growth in Fertilizer (NPK) Use, 1960-87
20
15
10
5
0
17.8
11
9.3
1960-70
1970-80
1980-87

fertilizer sector operations, nor were any policy shocks introduced. As a result, fertilizer use continued to grow at a high rate of 9.3% per annum in the 1980s.

Various policies affect the development of the fertilizer sector in the developing countries. The theory and practice of policy analysis, formulation, and implementation suggest that certain components of the following policies have relatively more influence on the fertilizer sector operations. Hence, these policies are selected for an in-depth analysis and evaluation:

1. Macroeconomic Policy.
2. Pricing and Subsidy Policy.
3. Organizational Policy.
4. Supply Policy.
5. Credit Policy.
6. Research and Extension Policy.
7. Environmental Policy.

5.2 Macroeconomic Policy

Three components of macroeconomic policy have relatively more impact on the fertilizer sector operations:

1. Foreign exchange allocation.
2. Exchange rate fluctuations.
3. Import restrictions.

5.2.1 Foreign Exchange Allocation

Untimely and inadequate allocation of foreign exchange adversely affects fertilizer use, production, and imports. Many developing countries do not have domestic capacity to produce all fertilizer products required for crop production. Even those countries who are endowed with raw materials or feedstocks need foreign exchange to import necessary plant, equipment, and technical know-how to convert raw materials into domestic production capacity. Furthermore, fertilizer production technologies are highly capital and foreign exchange intensive. For example, an ammonia-urea plant with a capacity of 1,000 tpd of ammonia and 1,500 tpd of urea costs anywhere from US $400 million to US $600 million of investment. Thus, for many developing countries, the availability of foreign exchange becomes critically important for import of finished products and raw materials for domestic production.

In many African countries, shortages of foreign exchange and debt crises have restricted fertilizer use to rather low levels (Figure 5.2). In 1987, of 40 sub-Saharan African countries, 20 used fertilizers only because these were available from donor-assisted sources either as grants or as loans (Table 5.1). Likewise, debt crises and foreign exchange shortages affected fertilizer use in many South American countries.

Not only is fertilizer use affected by lack of foreign exchange but also domestic capacity remains underutilized. In both Tanzania and Zambia, inadequate and untimely supply of foreign exchange prevented import of necessary raw materials and spare parts to operate fertilizer plants. Consequently, plants produced far below their capacity.

Thus, it is crucial that foreign exchange be allocated on time and in adequate quantities so that farmers can get fertilizers on time and producers do not underuse their productive capacity.

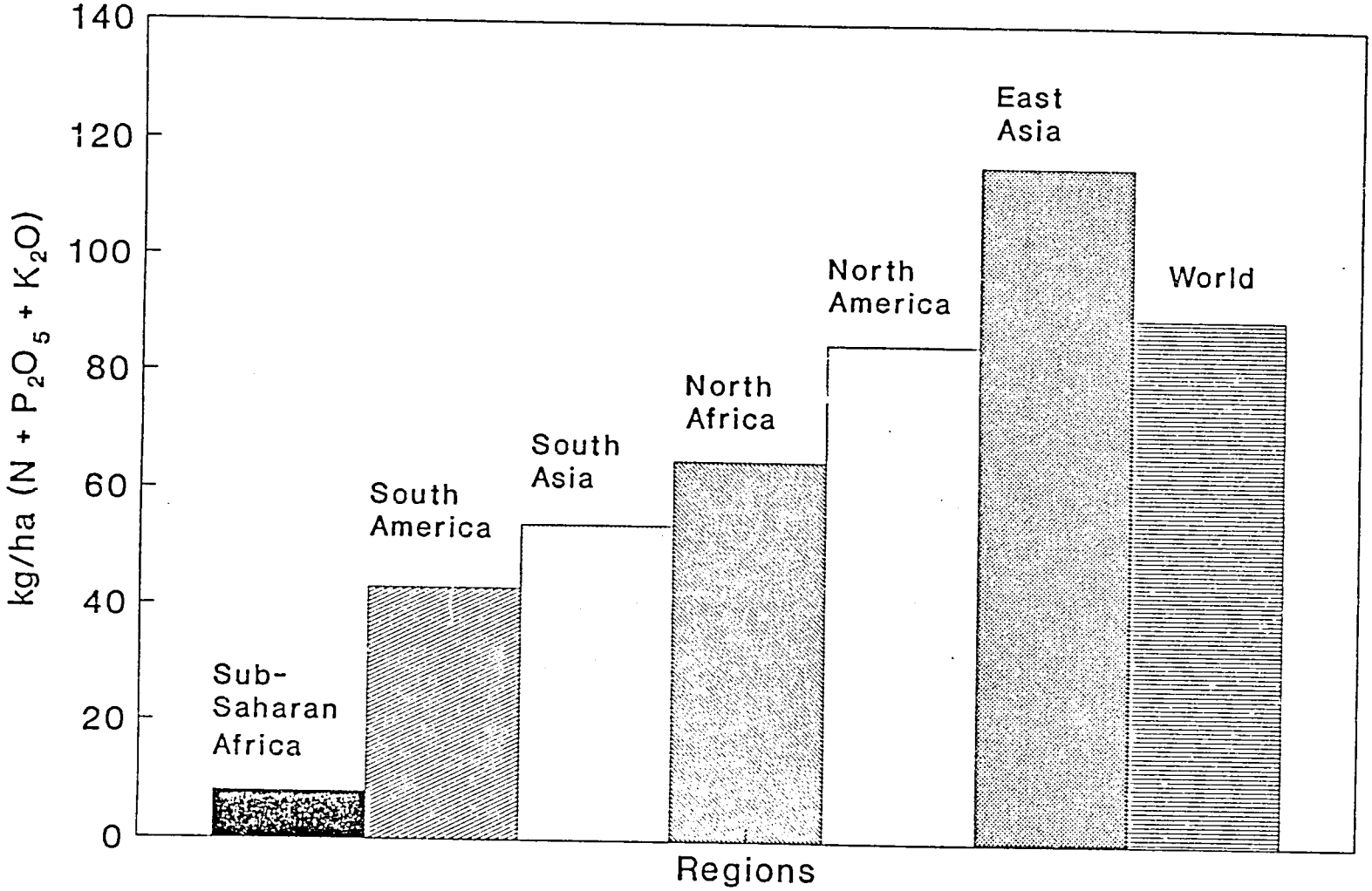


Fig. 5.2. Fertilizer use per hectare, 1988. Source: FAO [8].

Table 5.1. Sub-Saharan Africa: Distribution of Countries by the Ratio of Fertilizer Aid to Fertilizer Imports, 1985-1987

Ratio (%)	Number of Countries		
	1985	1986	1987
0	7	8	8
1-20	3	3	4
20-50	2	1	1
50-80	3	3	5
80-99	2	3	2
100	23	22	20
Total	40	40	40

Source: Fertilizer Economic Studies, Limited (FERTECON) (1989) Sub-Saharan Africa: A Review of Fertilizer Imports, 1985-87 (unpublished report).

In allocation of foreign exchange, one point needs stressing. Many governments are hesitant in allocating foreign exchange for import of fertilizers or raw materials and spares for fertilizer production because it is treated as an "expenditure" item and not as an "investment" item. It must be stressed that foreign exchange allocated to fertilizers should be treated as an investment item because foreign exchange spent on import of fertilizers results in savings of foreign exchange by import substitution and export promotion of agricultural products. In 1990, a US $1 spent on fertilizer imports could have saved and/or generated US $3-$7 in the developing countries.

5.2.2 Exchange Rate Fluctuations

In the 1960s and 1970s, many developing countries pursued a policy of fixed-exchange rate. Consequently, exchange rate was generally stable, and therefore the price of imported fertilizers did not change in the short and medium terms. Occasionally, these economies devalued their currencies to restore balance in their trade and capital accounts. However, in the 1980s, many countries moved to a flexible exchange rate system. Consequently, the exchange rate has depreciated significantly. For example, in 1982, Ghana's exchange rate was US $1 = ¢2.8. In 1990, under the free and flexible exchange rate system, this increased to US $1 = ¢350. Likewise, Nigeria's exchange rate changed from US $1 = ₦1 in 1985 to US $1 = ₦12 in 1990. Such depreciations of domestic currency lead to astronomical increases in domestic prices of imported fertilizer products. For example, in Ghana, the price of ammonium sulfate increased from ¢500/ton in 1983 to ¢62,000/ton in 1990.

Unless such increases are compensated by increases in crop prices and provisions for credit, these changes reduce incentives to use fertilizers. Under such circumstances, a phased and short-term program of subsidies may be desirable. Otherwise, the increases may lead to an irreversible decrease in fertilizer use and thereby in food and nonfood crop production. Policymakers have to safeguard against such shocks.

Import Restrictions–Many countries have restricted imports of foreign goods and services for good reasons: mainly, to promote and protect infant domestic industries. However, such restrictive policies have also protected inefficient industries. Consequently, either farmers or taxpayers or both have to suffer and bear the burden of such inefficiencies.

Many studies indicate that quotas are relatively more inefficient than tariffs for promoting domestic industrialization. The World Bank allows 15% protection for domestic industries. The optimum rate of protection differs from one country to the other. However,

policymakers should ensure that protection of inefficient (domestic) industries does not continue for a long time. Further, policymakers can use imports to create gentle pressure on domestic producers to improve their efficiency.

5.3 Pricing and Subsidy Policy

The main objective of a pricing policy is to provide incentives for efficient fertilizer use. In this arena, both crop and fertilizer prices are important. Another objective of the pricing policy is to provide a stable pricing environment so that fluctuations in prices and profitability of fertilizer use are minimized. High price fluctuations may produce cyclical investment and production behavior leading to excessive surpluses or deficits in crop markets and thereby reduced incentives for adoption of new technologies including fertilizer use. In many African and Latin American countries, the lack of a stable and remunerative pricing environment has discouraged fertilizer use in the 1980s.

Another issue in this area is the issue of fertilizer subsidy. The challenge here is to determine the optimum level of fertilizer subsidies so that food security may not be impaired. Because fertilizer and farm subsidies ultimately create fiscal burdens and become unsustainable, a critical evaluation of this policy is necessary. However, it must be stressed that the pricing and subsidy policy must be evaluated in a dynamic context of the changing social, political, and economic goals.

Most of the developing countries have made use of input subsidies. In a survey of 38 developing countries, FAO reported that 68% used fertilizer subsidies. Most developing countries used fertilizer subsidies to prevent the 1974-75 explosion of international prices from being reflected in the domestic prices and thereby prevented a deterioration in the cereals-fertilizer price ratio.

An analysis of fertilizer subsidies in developing countries for 1980-86 revealed that the region with the largest number of countries without fertilizer subsidies was Latin America. The Asian region had the largest number of countries with subsidies. Average growth rates of fertilizer consumption in those countries were twice as high as in those without subsidies. In the other regions, on the average, the countries with subsidies had positive growth rates, whereas fertilizer consumption declined in countries without subsidies.[19] However, the difference in the average fertilizer consumption growth rates should not be attributed entirely to crop-fertilizer price relationships. Adequacy of supply, timely distribution of fertilizers, and the efficiency of the crop marketing system also influence the use of fertilizers.

The main argument against subsidies is that their use encourages wasteful and misdirected use of resources because the prices no longer reflect real costs. Input subsidies, therefore, are generally considered less efficient than higher producer prices as a means of increasing output. However, fertilizer subsidies are more effective than produce price increases in raising the real incomes of small farmers with limited marketable surplus. Input subsidies have been widely used to maintain reasonable domestic price stability during periods of large increases in the prices of imported inputs. They have also been used to correct distortions in relative prices by providing incentive price-cost ratios.

Not only is an evaluation of the subsidy policy important, but also a proper sequencing and phasing are required for introducing changes in the policy environment. Ad hoc policy changes may become counterproductive and unsustainable and therefore may require policy reversals. On the other hand, well-managed and properly phased policy reforms not only are sustainable but also contribute to increased crop production and farm incomes through

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[19] Couston, J. W., and P. Narayan. 1987. "Role of Fertilizer Pricing Policies and Subsidies in Agricultural Development," FAO/FIAC, Rome, Italy.

increased fertilizer use. IFDC-managed and -implemented institutional and policy reforms in Bangladesh provide an example. Unlike the situation in Senegal and Venezuela, where the removal of fertilizer subsidies led to decreased fertilizer use, in Bangladesh the removal of fertilizer subsidies led to decreased fertilizer prices and increased fertilizer use (Figures 5.3-5.5). This result was achieved by synchronizing the subsidy removal programs with the development of a competitive market system, which promoted increased efficiency and decreased costs in marketing and distribution of fertilizer products.

In addition to crop and fertilizer prices, policymakers also have to decide about prices of raw materials like natural gas, fuel oil, electricity, phosphate rock, and others.

Plentiful availability of a certain feedstock, like natural gas or phosphate rock, may allow policymakers to set prices rather low, sometimes below their economic costs. Economists recommend that prices of nonrenewable resources should be set at their opportunity cost, that is, either at the price at which they could be imported or at their competitive use level prices. For example, if cement and cotton textile industries can pay higher prices than import parity price, then other industries, such as the fertilizer industry, should also pay high prices. On the other hand, if the country is an exporter of raw materials, then domestic industry should be charged export-parity equivalent price. Prolonged subsidization of domestic industries may lead to wasteful use of raw materials. For example, excessively low prices for natural gas in Algeria's fertilizer sector have resulted in high energy use for ammonia production.

Figure 5.3

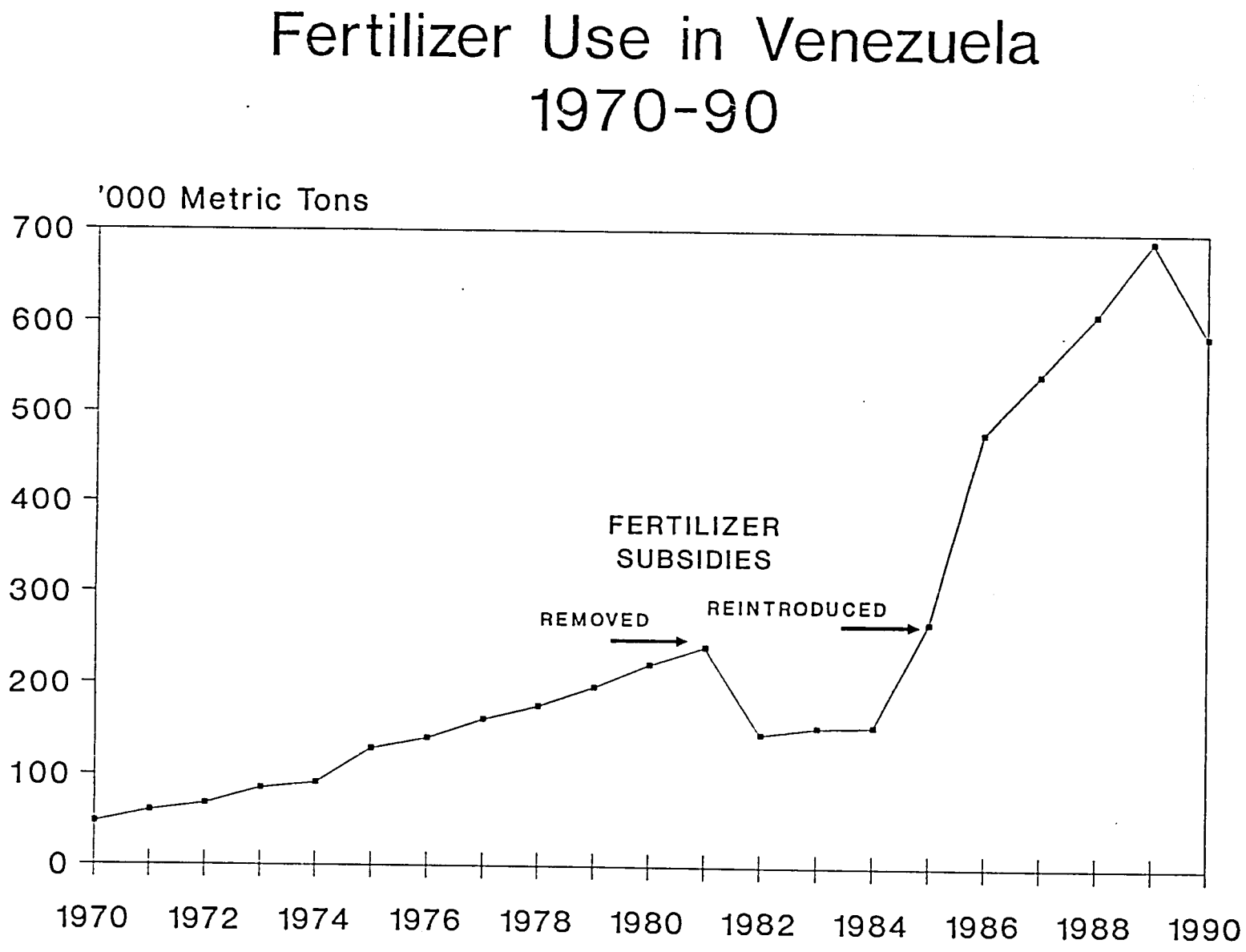

Fertilizer Use in Venezuela
1970-90
'000 Metric Tons
700
600
500
400
300
200
100
0
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
FERTILIZER
SUBSIDIES
REMOVED
REINTRODUCED

Figure 5.4

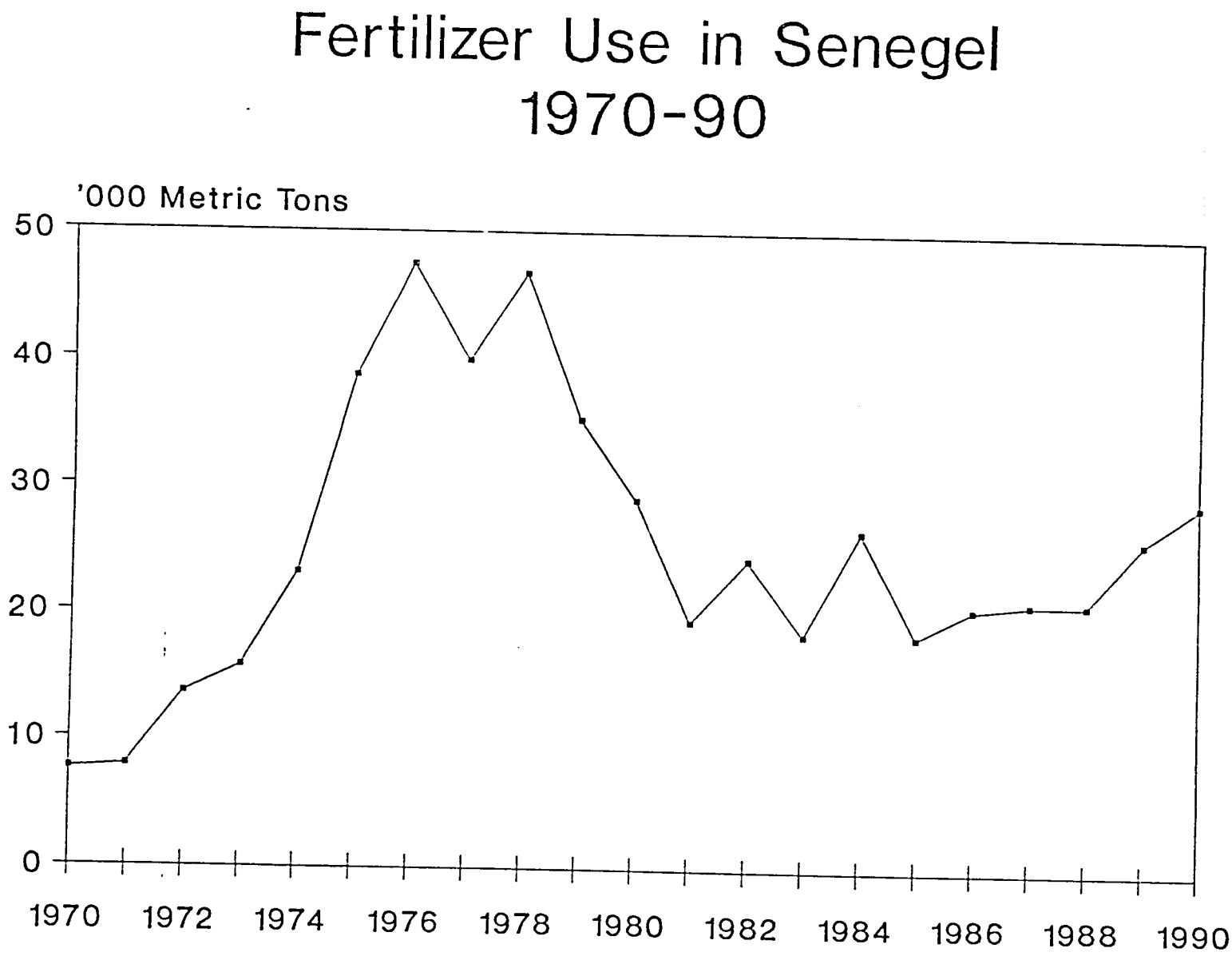
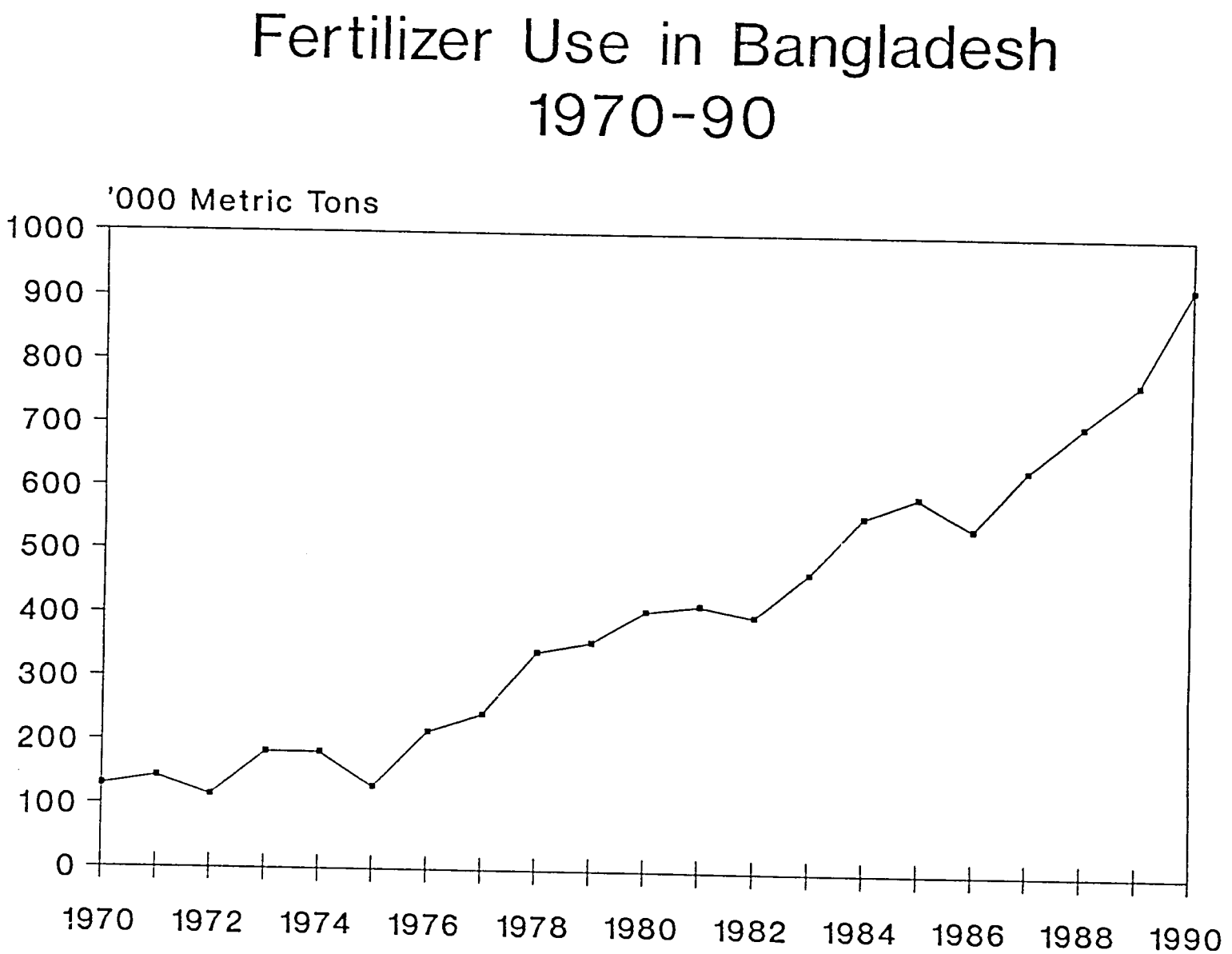

Fertilizer Use in Senegel
1970-90
'000 Metric Tons
50
40
30
20
10
0
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990

Figure 5.5


Fertilizer Use in Bangladesh
1970-90
'000 Metric Tons
1000
900
800
700
600
500
400
300
200
100
0
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990

National goals like food security, agricultural growth, regional development, and foreign exchange earnings will have an important bearing on determining raw material pricesfor the fertilizer industry. However, one thing is certain: if prices are kept either too low or too high, they will encourage suboptimal use of resources. A proper social cost-benefit analysis should be done to evaluate the efficiency of this policy.

5.4 Supply Policy

The main objective of the supply policy is to provide fertilizers to farmers at the lowest cost possible, through either domestic production or import or both.

In order to achieve relatively greater fertilizer security, many developing countries have strived to achieve fertilizer self-sufficiency, sometimes at a very high cost. If the country has plentiful natural gas or other raw materials, it can invest in fertilizer production facilities. However, in some countries, developmental costs of raw materials may outweigh the advantage gained by domestic production. For example, cost of fertilizer production in Tanzania was two times more than import cost, although natural gas was locally available. Consequently, the country could not find financial resources to implement that project. Likewise, a naphtha-based plant in Madagascar was built, but it never operated because domestic cost was much higher than import cost.

In the field of fertilizer production, one simple rule to follow is this: If a country does not possess any raw materials, do not build a plant based on imported raw materials. Even if it has one of the two or three raw materials needed to make fertilizers, it should be very cautious so that it does not end up with a "white elephant," as Sri Lanka and Madagascar did.

Another consideration is the size of market. Many countries in Africa have a rather small market (Table 5.2); modern technologies, however, require large-scale production to reap the benefits of economies of scale. If the domestic market is small, the country should explore opportunities for exports so that the plant operations are financially and economically viable.

Table 5.2. **Sub-Saharan Africa: Size Distribution of Fertilizer Use, 1987/88**

Size ('000 nutrient tons)	Number of Countries
Less than 5	17
5-10	5
10-20	6
20-50	7
50-100	3
More than 100	2
Total	40

Source: FAO.

Sometimes, some large countries have built plants that were not economically justifiable but were strategically desirable. Countries like India, China, Mexico, and Brazil have used this argument because their total dependence on international markets was perceived to be too risky for national food security. Such considerations, although desirable, should be kept to a minimum.

Because many countries do not have all the raw materials needed for fertilizer production, import policy should be designed to complement domestic production and supply. The success of import policy is dependent on a conducive macroeconomic policy. Adequate

and timely supply of foreign exchange is critical for importing fertilizers on time and in adequate quantities.

Last, supply policy should also promote use of domestic agrominerals. This could become a source of foreign exchange savings, provided cheap and subsidized fertilizers are not dumped in the market. However, the cost of development of mines and other infrastructure to facilitate the use of agrominerals should not be overlooked.

5.5 Credit Policy

Many developing countries have favored cheap credit policy. That is, interest charged on borrowed capital/loans was kept low, especially for agriculture and fertilizers. In some cases, such rates were negative because the inflation rate was higher than the interest rate.

Evidence from many World Bank and other donor-financed projects suggests that keeping interest rates low promotes either misuse or diversion of funds. Consequently, money borrowed for purchasing fertilizers or digging wells ends up being spent on other purposes.

Two aspects of credit policy merit special attention for fertilizer sector development. First, availability of funds and second, interest rates.

Evidence from several developing countries suggests that interest rates should not be kept very low. Developing the financial markets and increasing the supply of funds are better ways of keeping interest rates at affordable levels than are subsidies. Nevertheless, because of inherent risks and uncertainty in crop production, a small differential may be desirable; however, the degree of such differential will differ from country to country because of differences in ecological, technological, institutional, and infrastructural conditions.

The availability of funds for purchase of fertilizers has to be ensured through some special arrangements. Here, two aspects should be kept in consideration: first, availability of funds for farmers and second, availability of funds for fertilizer dealers.

Many programs have been designed to help farmers to borrow credit for fertilizer purchase and other agricultural needs. Loan recovery has always been a problem unless such loans were tied to crop purchase. Politicalization of lending institutions has led to relatively higher loan defaults. Proper management and discipline in assessing loan requirements and seeking adequate collateral may minimize such problems. Also, the problem is psychological. Many farmers feel that the government loans are grants. Hence, they never plan for repayment. Informing farmers about such issues can also help.

Because of government monopoly in fertilizer marketing and distribution, private dealers rarely participated in fertilizer marketing, although they were always involved in the distribution of pesticides and other chemicals. Now, as many countries are privatizing their fertilizer sector operations, ensuring adequate credit for private dealers has become an important issue. Policymakers have to keep two points in mind here.

First, many of these dealers are retailers; they did not have much dealings with the banks. Hence, the banks do not lend them money. Also, they have little to offer as collateral. Thus, the concept of warehousing collateral has to be popularized. Both bankers and dealers have to be educated about this concept. Under such schemes, fertilizer stocks in the warehouse are treated as collateral for bank funds, and a small quantity of fertilizer is issued to the dealer. As this quantity is sold, the dealer exchanges cash received from the sale of the first installment for the next shipment of fertilizers. Once the flow of funds is established, the dealer has the ease of trading funds for fertilizers and is not constrained by lack of funds in trading activities.

Second, in the transition phase, the national government may have to provide some type of credit guarantee for these dealers so the bankers will be willing to risk their funds.

5.6 Organizational Policy

Many developing country governments have created monopolies for fertilizer import, production, and distribution. At the initial stage of development when fertilizer products are new and the fertilizer market is small, the direct involvement of governmental agencies may be desirable. However, when the market is fully developed, the continued presence of the government in marketing and distribution of fertilizers may become counterproductive. For example, in one African country, farmers have to travel 18 miles to buy a bag of fertilizer. Furthermore, as the governmental depot is open only on a limited number of days and hours in a week/month, many farmers have to make several trips to buy even one bag (50 kg) of fertilizer products. Such marketing arrangements discourage fertilizer use and prevent potential increases in crop production and farm incomes.

A competitive marketing system eliminates these inefficiencies and provides fertilizers at a lower cost and on time, as has happened in Bangladesh. To quote the *Bangladesh Times*:

> Fertilizer sales increase by 20% (over 1989 level).... Farm-level prices of fertilizer fell by at least 10% in 1989/90 over the previous year due to increased role of private sector in distribution and marketing.

Likewise, efficient organizational arrangements are also needed for fertilizer imports and production. However, because of economies of scale and foreign exchange requirements, the type and size of viable organizations for these activities may differ from those for marketing and distribution. A proper analysis of the country's needs, resources, and the level of development is required to identify viable and sustainable organizations for various domains of the fertilizer sectors in the developing countries. The government policy should

actively encourage the development of competitive markets and private sector agencies in dealing with the fertilizer imports, marketing, and distribution.

5.7 Environmental Policy

The lack of proper policy in this area has led to soil degradation, deforestation, and desertification in many developing countries and pollution of land, air, and water in the developed countries. Unless proper measures are developed and appropriate policies are introduced, the latter environmental problems may also afflict many developing countries. The identification and promotion of environmentally safe fertilizer practices and products are thus essential to achieve multiple objectives of food security, clean environment, and sustainable resource base.

In formulating and assessing the impact of environmental policy on fertilizer use and supply, two aspects should be kept in mind. First, what role can efficient fertilizer use play in preventing soil degradation resulting from the depletion of plant nutrients? Second, what chemical pollutants are associated with fertilizer use? Nitrate leaching, eutrophication, and nitrous oxides are some problems that must be controlled. Considerable research is needed to formulate appropriate policies in this area because adequate information is lacking.

5.8 Research and Extension Policy

Efficient and environmentally sound fertilizer use requires adequate institutional capacity in research and extension. Without adequate research and extension, fertilizer use may not be proper. Inappropriate fertilizer products may be distributed to farmers. Likewise, without proper soil and crop analysis, farmers may use inappropriate products. For example,

acidic soils may require heavy doses of lime before nitrogen and phosphate fertilizers become productive.

Not only do many developing countries not have adequate capacity for research and extension, but they also do not establish proper coordination between research and extension. Consequently, many research findings never get translated into farmer recommendations, and many extension recommendations never have adequate research support. Hence, adequate funding should be provided for research and extension, and proper coordination should be established between research and extension.

Chapter 6

Evolution and Assessment of the Policy Environment in Mali

6.1 Introduction

In Chapter 5, various components of different macro- and microeconomic policies, sectoral policies, and environmental policies have been identified in both analytical and empirical ways. In this chapter, the evolution of Mali's policy environment as related to the seven policies mentioned in Chapter 5 is pursued. Also, these policies are assessed with respect to their impact on fertilizer use, supply, prices, and other indicators.

6.2 Macroeconomic Policy

Three components of macroeconomic policy are analyzed below, namely, allocation of foreign exchange, exchange rate policy, and import controls.

6.2.1 Allocation of Foreign Exchange

As indicated in Chapter 2, Mali's membership in the Union Monétaire Ouest Africaine has the advantage of removing any foreign exchange constraints the country might have with regard to fertilizer importation in that the convertibility of the Franc de la Communauté Financière Africaine (FCFA) is guaranteed by France. Moreover, a major portion of Mali's fertilizer imports comes from Senegal and Côte d'Ivoire who are members of the same monetary union as Mali.

Donor aid has not been provided in the form of foreign exchange for fertilizer imports. Instead, donors have provided direct aid-in-kind (fertilizers) to the Government of Mali, chiefly as a means to alleviate the country's balance of payments difficulties.

6.2.2 Exchange Rate Policy

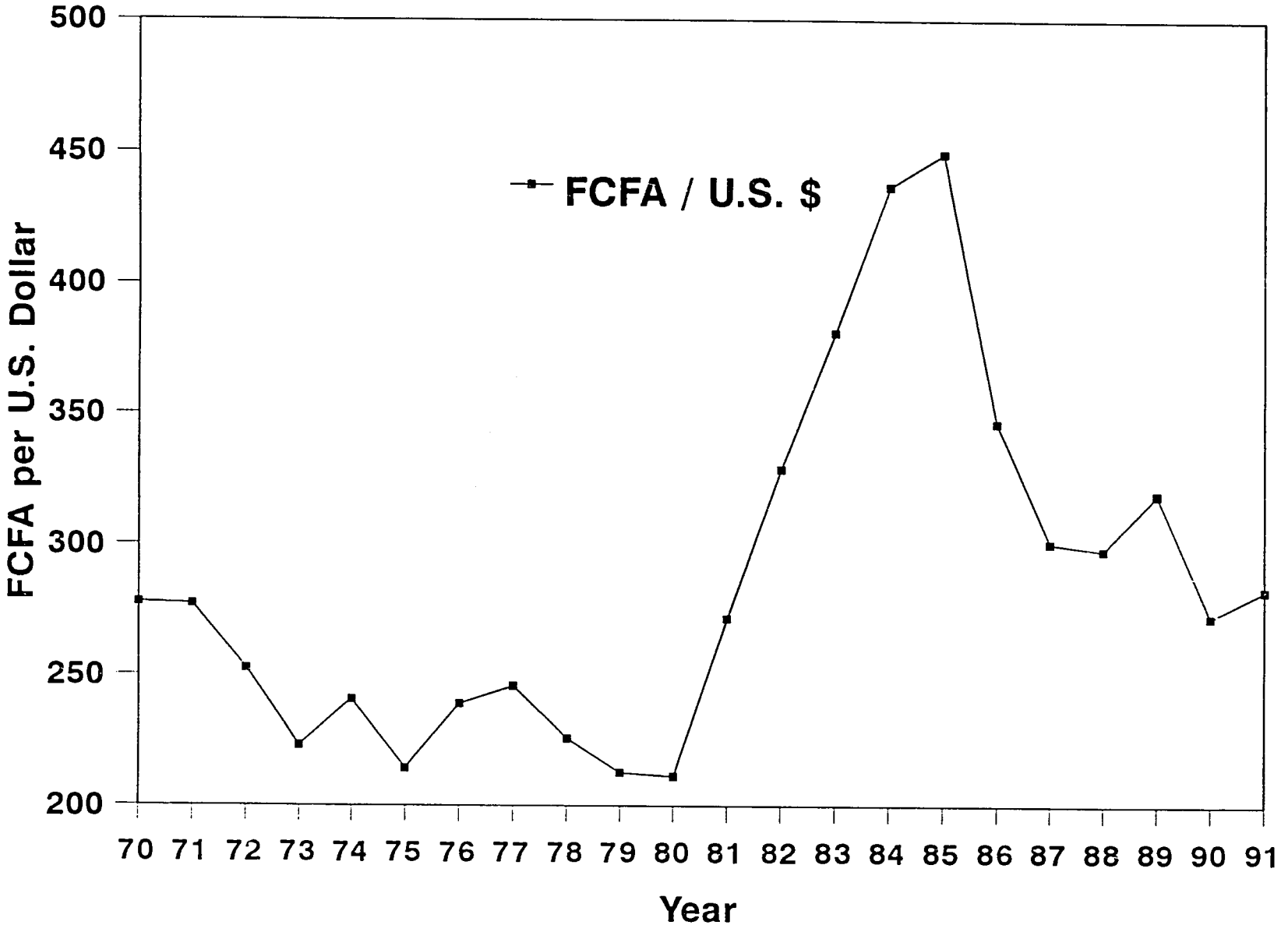
Membership in the UMOA implies that Mali loses its national monetary autonomy because each member country is subject to a common and fixed exchange rate policy. In 1990, about 80% of fertilizers imported by CMDT originated from Senegal and Côte d'Ivoire. In the same year, about 90% of fertilizers imported by COMADIS originated from SENCHIM, Senegal.[20] These fertilizer imports were paid for in a common currency, the FCFA, which has a fixed exchange parity with the French franc. As a result, fluctuations in the exchange rate between the FCFA and other major currencies, such as the U.S. dollar (Figure 6.1), have very little or no impact on fertilizer imports in Mali. Because the prices of most internationally traded agricultural inputs are expressed in U.S. dollars, only private traders who do business outside the franc zone are affected, but they are very few. At the national level, all transactions are made within the same monetary zone.

6.2.3 Import Controls

There are presently no quantitative restrictions on imports of agricultural inputs including fertilizers. However, quality and safety standards regarding chemicals and other farm inputs are strictly enforced. It was mentioned in Chapter 4 that ethno-political problems have interrupted the extraction of TPR for nearly 2 years. If these problems

[20]Interview with CMDT and COMADIS officials.

Figure 6.1 Mali: Annual Average Exchange Rates, 1970-91



Source: International Financial Statistics, IMF

persist much longer, imports of phosphatic fertilizers will continue and may even increase in the medium term. However, the outlook may be quite different when mining operations resume and plants are operating at or near full capacity. One possibility is that deliberate government efforts to encourage the use of domestic agrominerals may lead to the adoption of a trade policy that imposes quantity restrictions on imports of phosphatic fertilizers.[21]

6.3 Pricing and Subsidy Policy

6.3.1 Pricing Policy

When the parastatal agency SCAER handled all imports of fertilizers and other farm inputs, the Government followed a policy of pan-territorial pricing of fertilizer products. As a result, fertilizer prices were uniform throughout the country regardless of transportation, storage, handling, and other costs.

The fertilizer pricing policy had two implicit goals. First, to promote fertilizer use, fertilizer prices were kept low and stable in the 1970s. Second, pan-territorial pricing of fertilizers ensured that farmers located in remote areas were not penalized by higher transportation and distribution costs.

Since the dissolution of SCAER in 1980, ODRs have assumed the responsibility for fertilizer procurements to meet the requirements of farmers in their zones of operation. The fertilizer product prices paid by farmers are therefore determined by the ODRs themselves, based on their procurement, marketing, and distribution costs. The fertilizer product prices paid by farmers in the CMDT and OHV zones, for example, clearly reflect the significant

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[21]Interview with SEPT officials.

differences in fertilizer procurement, marketing, and distribution costs among ODRs. The following section discusses fertilizer product price determination by CMDT and OHV.

6.3.1.1 Fertilizer Pricing by CMDT

Fertilizer product price determination by CMDT in 1990 followed the structure presented in Table 6.1. Four products were considered, namely, cotton complex, cereal complex (15-15-15), urea, and TPR. The respective product prices took into account the c.i.f. price; interest, administrative, handling, and transport charges; and insurance cost. It should be noted that CMDT sells fertilizers to its farmers on short-term credit, usually for a duration of one cropping season. In 1990, the CMDT interest charge on short-term credit for fertilizer purchases ranged between 13% and 14% of the actual cost of the fertilizer products. Only urea was sold on interest-free credit.

Table 6.1. CMDT Fertilizer Product Price Determination, 1990 (FCFA/kg)

	Cotton Complex	Cereal Complex	Urea	TPR
c.i.f. price, CMDT warehouse	92.00	89.38	100.50	60.97
Interest charge	16.10	15.64	0.0	10.67
Administrative charges	10.30	10.14	0.0	0.00
Transport charge	1.10	1.60	0.5	2.80
Handling charge	0.50	0.50	0.5	0.50
Insurance cost (0.5% of c.i.f. cost)	0.50	0.45	0.0	0.00
Total cost	120.50	117.71	101.50	74.94
Price paid by farmers	120.00	105.00	100.00	30.00
Difference (total cost minus price paid by farmer)	0.50	12.71	1.50	44.94
Subsidy (% of total cost)	0.0	11.00	1.50	60.00

Source: CMDT

It must be acknowledged that the transport charge is very low for each product and does not cover the economic cost to CMDT of transporting the fertilizer to the farm level. However, it must be stressed that this is a "special" transportation charge. CMDT usually programs its fertilizer deliveries at village warehouses to coincide with cotton harvests. This cost-saving measure ensures that trucks do not return empty to Bamako after delivering fertilizers to village warehouses but can bring back cotton in full or partial repayment of farmers' fertilizer loans. The "special" transportation charge applies particularly in cases of late fertilizer deliveries by the supplier due to no fault of the farmers.[22]

6.3.1.2 Fertilizer Pricing by OHV

Fertilizer product prices in the OHV zone are highly influenced by fertilizer supply and demand factors. A "barème" or price schedule provides guidelines for setting product prices. The cash price for a 50-kg bag of urea, for example, is the cost price on the domestic fertilizer market in Bamako, plus transportation cost to OHV village warehouses. Fertilizers sold on short-term credit, that is, for a duration not exceeding one crop year, are sold at cash price plus an interest charge ranging from 13% to 14% of actual cost. This interest charge is roughly equal to the rate that the BNDA charged OHV in 1991.

For the 1988/89 crop year, OHV purchased a 50-kg bag of urea for FCFA 7,250. It cost OHV FCFA 330 to transport a 50-kg bag of urea from Bamako to village-level warehouses. The 50-kg bag of urea was then sold to farmers at FCFA 8,000. This is equivalent to a price of FCFA 160/kg of urea for cash purchases. In the same year, the credit price for 1 kg of urea was FCFA 174, 9% higher than the cash price.

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[22]Interview with CMDT officials

Changes in crop prices are also an important component of agricultural pricing policy in Mali. In addition to the producer prices of Mali's major export crops, all cereal prices until the 1987/88 cropping season were set by decree at the beginning of each cropping season. These official prices were determined on the basis of costs of production estimates provided by the Institut d'Economie Rurale (IER). The decree distinguished two price schedules: one, called the "barème" or price list, for coarse grains and the other for paddy rice. These price schedules also fixed the marketing margins of the ODRs and the Office des Produits Agricoles du Mali (OPAM), the parastatal agency that was responsible for cereal marketing. The producer, wholesale, and retail prices at which these institutions could buy and sell cereals were set at a uniform level and were pan-territorial in nature.

The overall objective of crop pricing policy was to improve the economic environment so as to offer incentives for farmers to increase agricultural production through investment in productivity-enhancing activities (Ministère de l'Agriculture, 1987).

Cereal Sector–During the 1981-87 period, the official prices of cereals (millet/sorghum and maize) were, in effect, the intervention prices of OPAM. With the launching of the Programme de Restructuration du Marché Céréalier (PRMC) in 1981, the Government intended to orient market prices in the desired direction. However, producer prices fluctuated widely with demand and supply over the years, and market orientation by means of official prices proved to be a policy failure.

Since the PRMC was launched, price information has been systematically collected on selected rural markets in Mali. Regional price variations of a limited magnitude have been observed between food-surplus regions such as Sikasso and food-deficit regions such as Kayes. Seasonality of crop prices is also noteworthy. For example, prices are lowest at the

time of harvest and highest in the period just preceding the harvest. Relatively stable prices are observed during the marketing season, usually between January and March of each year.

Occasional intervention in cereal markets by parastatal agencies upsets this seasonal price cycle. This was the case when OPAM intervened in the cereals market during the 1985/86 marketing campaign. Prices rose artificially only to fall sharply at the end of the marketing season. It was very difficult to assess the role of OPAM in the marketing of cereals due to lack of reliable data (Ministère de l'Agriculture, 1987). The role of OPAM is now limited to (1) maintaining cereal stocks for food security, (2) managing food aid, and (3) supplying cereals to food-deficit regions (Ministère de l'Economie et des Finances, 1992).

Rice Sector—Up to 1992, the Government has maintained a price support policy for rice producers at the Office du Niger (ON). This policy is characterized by an intervention price of 70 FCFA/kg at the farm level, a price that is much higher than what the producer could get on the free market. However, because rice imports are not properly controlled, cheaper imported rice floods the domestic market and renders local rice uncompetitive. Thus, the Government, acting via the PRMC regularly has to finance the losses of the rice mills, thereby introducing additional fiscal burdens on the national economy.

In the 1990/91 cropping season, national cereal shortages led to sharp increases in the price of millet and sorghum; the substitution of rice for millet led to increased demand for rice and maintained a satisfactory market price for local rice. The market price for husked rice ranged from 135 to 150 FCFA/kg, two times the price of 70 FCFA/kg offered by the rice mills. However, it is conceivable that, at the current level of control on rice imports and with millet/sorghum production remaining constant, a steady increase in

national rice production will lead to a decline in the price of local rice in the medium term (IER, 1992).

6.3.2 Economics of Fertilizer Use

Profitability of fertilizer use can be determined by evaluating the economics of fertilizer use. To do this, we need information about crop response and crop and fertilizer prices.

Trends in fertilizer and crop prices have already been analyzed in Chapter 4. A brief analysis of crop response to fertilizer use is done here. Henao, Coulibaly, and Traoré (1992) have estimated and analyzed fertilizer response functions for several crops in different agroecological zones in Mali. The fertilizer elasticity of yields for different crops is summarized in Table 6.2. These estimates suggest that many crops respond well to fertilizer use, although the response to different nutrients varies among different crops. For example, the response of maize yield to phosphate use is higher than the response to nitrogen use. Likewise, legumes respond better to phosphate use than to nitrogen use; legumes have the capability to fix nitrogen from the atmosphere.

To estimate profitability of fertilizer use, we need estimates of marginal productivity of fertilizer use. The estimated response functions presented in Table 6.3 were used to estimate the marginal productivity of fertilizer use at three levels of nutrient use, namely, 50, 100, and 150 kg of nutrients per hectare (Table 6.4). These nutrient use levels correspond to N, P_2O_5, and K_2O combinations of (30-10-10), (50-30-20), and (90-30-30). It should be noted that, because fertilizer recommendations by a national extension service were not readily available, these three levels of nutrient use were chosen primarily for illustrative purposes. Of the three nutrient use levels, the first level, that is, 50 kg of nutrients, roughly approximates the nutrient recommendations of CMDT and OHV.

Table 6.2. Mali: Fertilizer Elasticity of Crop Yields

Crops	Elasticity			
	N	P_2O_5	K_2O	NPK
Groundnut	0.01	0.07	0.07	0.10
Flooded rice (transplanted)	0.10	0.01	-0.004	0.13
Wheat	0.08	0.06	0.001	0.15
Sugarcane	0.03	0.03	-0.04	0.01
Cotton	0.06	0.04	0.06	0.16
Lowland rice	0.08	0.03	0.10	0.08
Maize	0.10	0.21	-0.02	0.28
Millet	0.02	0.03	0.09	0.11
Cowpeas	-0.005	0.06	0.002	0.05
Upland rice	0.10	0.06	-0.03	0.18
Sorghum	0.03	0.08	0.06	0.14

Further, it should be stressed that the response functions used in the analyses were derived for normal rainfall years and are based on the experiments conducted by researchers on the farmers' fields as well as on experiment stations. Hence, the outcomes are based on a state of perfect knowledge and no uncertainty. However, most farmers are not in possession of complete knowledge about a costly input like fertilizers, nor do they have normal rainfall in all years. The severest drought in Mali occurred in 1973-76. Exceptionally dry weather conditions were also reported in 1983, 1984, 1987, and 1988. Rainfall uncertainty is much higher in the northern regions of Mali than in the southern regions. Thus, unless both of these factors are fully taken into account, results derived from these response coefficients should be interpreted with caution. Conclusions drawn from these data must also be adjusted for the uncertainty resulting from fluctuations in crop prices.

Table 6.3. Mali: Fertilizer Response Functions, All Crops

Dependent Variable: Yield by Crop	Independent Variables			Statistics		
	Intercept	NPK	NPK^2	Sample Size	R^2	Average Yield
Groundnut	1,015.40 (17.79)	11.17 (13.05)	-0.04 (-12.33)	333	0.34	1,615
Flooded rice (transplanted)	1,854.30 (3.22)	15.79 (2.07)	-0.03 (-1.44)	26	0.26	3,352
Wheat	980.44 (9.16)	8.21 (7.63)	-0.02 (-5.93)	275	0.24	1,909
Sugarcane	53,036.00 (8.46)	209.18 (4.50)	-0.47 (-5.57)	212	0.16	68,412
Cotton	798.96 (7.31)	6.85 (5.39)	-0.02 (-4.45)	187	0.16	1,414
Lowland rice	2,218.10 (8.65)	18.59 (6.00)	-0.05 (-5.67	294	0.11	3,605
Maize	689.25 (4.31)	10.21 (6.42)	-0.02 (-4.67)	432	0.12	1,832
Millet	694.60 (10.66)	2.98 (6.31)	-0.004 (-5.31)	430	0.098	1,112
Cowpeas	572.10 (10.37)	4.36 (2.73)	-0.03 (-2.89)	260	0.03	690
Upland rice	1,546.70 (5.04)	16.04 (4.16)	-0.03 (-2.97)	116	0.20	3,076
Sorghum	906.18 (14.40)	6.52 (9.71)	-0.01 (-7.64	482	0.21	1,564

Notes:
1. Numbers in parentheses are t-statistics.
2. Fertilizer (nutrient) application rate and crop yield are in kg/ha.

Table 6.4. Estimated Marginal Productivity of Fertilizer Use
(kg crop output/kg nutrient)

	Fertilizer Application Rate (nutrient kg/ha)		
Crop	50	100	150
Millet	2.6	2.2	1.8
Sorghum	5.5	4.5	3.5
Maize	8.2	6.2	4.2
Wheat	6.2	4.2	2.2
Rice (flooded)	12.8	9.8	6.8
Cowpeas	1.4	-1.6	-4.6
Groundnut	7.2	3.7	-0.3
Cotton	4.9	2.9	0.9

Source: Derived from data in Table 6.

The estimates of marginal profitability of fertilizer use at the three levels of nutrient use and the prevailing crop prices in 1990 are summarized in Table 6.5. It is clear from the table that at the low level of fertilizer application rate, namely 50 kg/ha, fertilizer use was profitable on all crops except millet. The marginal profitability was much higher for rice, cotton, and groundnut than for maize and sorghum. However, at the highest level, fertilizer use was profitable only on rice. Fertilizer use on sorghum, millet, and maize was not profitable at the 100 kg/ha and 150 kg/ha levels. Since these three cereals account for more than 80% of the cereals produced in Mali, unprofitability of fertilizer use at higher levels may require some changes in the policy environment. Thus, at the medium level of fertilizer application rates, fertilizer use in Mali reveals a dual pattern: highly profitable for export promotion and import substitution crops like cotton, groundnut, and rice; and highly unprofitable for subsistence crops like millet, sorghum, and maize. These conclusions may change if we make allowance for imperfect knowledge and uncertainty of rainfall and crop prices. Hence, additional data, analysis, and research are needed.

It should be pointed out that the conclusion based on marginal response coefficient is always different from the one based on average response coefficients used in the calculation of value-cost ratios (VCR). Since the average response is always higher than the marginal response, the VCR approach overestimates the profitability of fertilizer use, and may lead to undesirable policy recommendations.

6.3.3 Subsidy Policy

In order to achieve the goals of the fertilizer pricing policy in Mali, fertilizer subsidies were introduced in the early 1970s. Table 6.6 provides information on fertilizer subsidies as a share of actual cost of the main fertilizer products used in Mali during the 1974-76 period.

These subsidy rates ranged from 44%-78% of actual cost in 1974 to 44%-73% in 1975 and 1%-30% in 1976.

Table 6.5. Estimates of Marginal Profitability of Fertilizer Use (FCFA/kg)

	Fertilizer Application Rate (nutrient kg/ha)		
Crops	50	100	150
Millet	(120)	(139)	(157)
Sorghum	13	(33)	(79)
Maize	47	(23)	(93)
Rice (flooded)	758	532	290
Groundnut	278	26	(250)
Cotton	177	7	(164)

Note: 1. Figures in parentheses indicate loss in fertilizer use.
2. The following crop and nutrient prices (FCFA/kg) are used in calculating marginal profitability: groundnut–72, paddy rice–78, cotton–85, millet/sorghum–46, and maize–35; N–217.4, P_2O_5–312.8, and K_2O–175.
3. Marginal profitability equals value of marginal product less cost of nutrient use.

Table 6.6. Mali: Fertilizer Subsidy Rates, 1974-76 (% of actual cost)

Year	Cotton Complex	Urea	SSP	TSP	DAP
1974	69	71	44	54	78
1975	63	65	44	47	73
1976	19	7	5	1	30

Source: IFDC, *West Africa Fertilizer Study*, Volume 3, Mali, 1976.

Fertilizer subsidies were substantially reduced to a level of about 15%-20% of actual cost in the late 1970s and the early- to mid-1980s, and they were officially abolished in 1987 (Ministère de l'Agriculture, 1987).

At present, there are no explicit agricultural input subsidies included in the government budget; however, farm inputs, including fertilizer, are still being subsidized, both explicitly and implicitly by some rural development agencies, including NGOs. Because relevant information on the NGOs and other rural development agencies is not available, the experience of CMDT will serve as an example.

Over the past several years, the CMDT, while benefiting from reduced import costs, was able to phase out fertilizer subsidies, the levels of which were 21% in the 1983/84 cropping season, 27% in 1985/86, 13% in 1986/87, and 0% in 1987/88 (Ministère de l'Agriculture, 1987). It should be mentioned that the fertilizer subsidies practiced by CMDT are usually made possible by donor assistance through fertilizer aid. In 1990, for example, the price of urea was subsidized at 1.5% of actual cost, while cereal complex and TPR were subsidized at 11% and 60%, respectively (Table 6.1). It must be emphasized that TPR has always been heavily subsidized by CMDT, largely in an effort to encourage its use. Furthermore, the "special" transport charge referred to earlier represents a hidden subsidy.

6.4 Organizational Policy

The organizational arrangements for fertilizer procurement, marketing, and distribution in Mali evolved in two distinct phases during the 1970-90 period.

In the first phase (1970-80), SCAER was solely responsible for importing fertilizers. Once the ordered fertilizers were delivered to the ODR warehouses, the ODRs then performed the marketing and distribution functions and also carried fertilizer stocks on

behalf of SCAER. Inherent in these arrangements was a credit scheme under which the ODRs were not accountable to SCAER for loan defaults by farmers. As a result, SCAER accumulated massive losses that worsened the country's annual budget deficits. These organizational arrangements were highly ineffective. Consequently, SCAER was dissolved in 1980.

In the second phase, the Government realized that greater efficiency in agricultural input procurement, marketing, and distribution could be achieved through alternative organizational arrangements. Therefore, the major ODRs (CMDT and ON) were officially authorized to import fertilizers for themselves and for other (smaller) ODRs. Furthermore, under the Structural Adjustment Program, direct input subsidies have been phased out, fertilizer product prices have been liberalized, and private sector involvement in the fertilizer sector operations is strongly encouraged. However, further research is needed to assess the extent to which the private sector is involved in the fertilizer sector operations and its impact on fertilizer use in Mali.

Some recent developments in organizational arrangements within ODR zones are worth noting. In the OHV zone, for example, Village Associations (AVs), under the leadership of their organizers, may soon obtain their fertilizer requirements directly from private fertilizer dealers and not have to depend on OHV to provide this service. Details on this development are provided in the section dealing with Supply Policy.

Another major development in organizational arrangements affecting the fertilizer sector concerns the production and marketing of TPR. Until 1988, production and commercialization of TPR was undertaken by the Société Nationale des Ressources Minières (SONAREM), a parastatal agency that has produced TPR since 1976 (MDIT, 1988). On September 16, 1989, the Société pour l'Exploitation des Phosphates du Tilemsi

(SEPT), a joint-venture, limited-liability company, was created to take over from SONAREM the functions of TPR production and marketing in Mali. From then on, SONAREM would be involved mainly in mineralogical research. Shareholders of SEPT include CMDT (about 60%), the Government of Mali, Office du Niger, and SONAREM. Discussions are still underway between Government officials on the extent of the Government's involvement in this enterprise. However, according to agreements signed by the Government and the World Bank and IMF, the Government's share must not exceed 20%.

It was mentioned in Chapter 4 that ethno-political problems in the north of the country have caused production of TPR to be halted for nearly 2 years. So SEPT has actually operated for roughly 18 months since it was created. Due to insufficient information, further research is needed before SEPT can be evaluated for its impact on fertilizer use from a policy environment perspective.

6.5 Supply Policy

It must be stressed that Mali does not have a clearly articulated national fertilizer supply policy. What we know is that the country has moved from a phase where one parastatal agency (SCAER) imported all the agricultural inputs to a phase where all the ODRs are free to develop their input supply strategies and only two ODRs (CMDT and ON) can import fertilizers. One implication of this is that each ODR can formulate its own input supply policy.

Mali has depended highly on fertilizer imports and fertilizer aid to meet its fertilizer needs. As indicated in Chapter 5, the main objectives of the supply policy are to provide fertilizers to farmers in the right quantities, at the right time, and at affordable prices. In

this respect, the supply policy can be considered successful in some ODRs, such as CMDT, and less successful in others, such as OHV. However, in the OHV zone, organizers of Village Associations increasingly ensure the supply of farm inputs, including fertilizers, pesticides, and plant treatment equipment by negotiating orders directly with private fertilizer and other input dealers. As a result, during the 1990/91 cropping season, 27 Village Associations contacted seven private dealers on behalf of their members for the supply of fertilizers, pesticides, and plant treatment equipment. The total monetary value of these orders was FCFA 74.9 million, compared with FCFA 20 million in the 1989/90 cropping season.

Besides the profits made by the Village Associations, their members also benefit from relatively lower fertilizer product prices. This had a positive effect on their individual farm incomes. Consequently, the number of Village Associations increased from 27 in 1990/91 to 80 in 1991/92 cropping season. With 12 private input dealers involved, the monetary value of fertilizer, pesticides, and plant treatment equipment orders was estimated at FCFA 320 million, representing an increase of 327% over the 1990/91 level. With such impressive results, OHV is seriously considering the possibility of allowing the Village Associations to completely take over the role of ensuring input supplies to their members through direct negotiations with private dealers (OHV, 1990/91).

Under this arrangement, farmers get their fertilizers on time, in the right quantities, and at lower prices. If this experiment continues to be successful, it has the potential of spreading to other ODRs. Future research should keep abreast of developments in this area.

With regard to TPR, whether it is economically sound to use domestically produced PR or to import phosphatic fertilizers depends to a large extent on the cost of TPR relative

to the cost of imported phosphatic fertilizers such as DAP. To make this comparison we need information on the cost of production of TPR and the world price of DAP. The cost of production structure for TPR in 1990/91 is presented in Table 6.7. It cost SEPT 57,591 FCFA (roughly $211) to produce 1 ton of ground PR. The same ton of ground PR was sold in Koutiala (in southern Mali) for 59,750 FCFA (roughly $219) and in Sikasso (also in southern Mali) for 60,930 FCFA (roughly $224). Compared to the world price of $118 per ton of ground PR in 1990, the SEPT prices were not competitive. However, it would be misleading to infer that the farmer would have been better off using imported DAP based on these price comparisons, because TPR was sold to farmers (in the CMDT zone, for example) at highly subsidized prices. Nevertheless, further research is needed in the area of economic feasibility of TPR.

Table 6.7. Mali: Cost of Production of TPR, 1990/91[a] (FCFA)

Cost Item	Total Cost	Cost Per Ton
1. Extraction	87,565,570	4,453
2. Transportation of PR	104,954,063	5,338
3. Price at factory head	192,519,633	9,791
4. Ground phosphate equivalent	192,519,633	10,728
5. Factory storage	88,516,956	4,932
6. Conditioning	61,672,342	3,437
7. Overhead	244,261,485	13,612
8. Warehousing	14,122,608	787
9. Cost of production (ground PR) (Items 4+5+6+7+8)	601,093,134	33,496
10. Evacuation of ground PR	299,944,210	24,088
11. Cost price of ground PR	901,037,344	57,591

a. Calculations are based on 19,660 tons of PR and 17,945 tons of ground PR.

6.6 Agricultural Credit Policy

6.6.1 Evolution of Institutional Agricultural Credit

Up to the late 1970s agricultural credit schemes as well as the sale of agricultural inputs and implements were under the responsibility of SCAER, who also operated as a procurement unit for rural service institutions, which served as a link between it and the farmers. Although SCAER loans were interest-free, they attracted a commission on sales to the ODRs, which were also responsible for collecting amounts due for repayment and the storage of inputs on behalf of SCAER. This credit scheme, in which the ODRs were in no way liable for its repayment, was found to be ineffective.

SCAER was dissolved in 1980 and replaced in 1981 by the BNDA whose purpose was to provide technical and financial assistance to any project capable of promoting rural development in Mali. Thus, in addition to this activity, BNDA also undertakes the other banking operations.

Alongside the BNDA, whose activities remain concentrated in "low-resource" farming areas, a diversified financial intermediation capacity was systematically developed through the ODRs, the financial NGOs, and other rural development projects. The diversity of the agricultural credit facilities currently available testifies to the nonexistence of a clearly defined and planned national agricultural credit policy.

The various categories of credit facilities granted by these institutions are presented in Table 6.8.

Table 6.8. Mali: Agricultural Credit Sources and Types of Loans Provided

Commercial Banks	Loans to Traders and Major Operators in the Rural Sector
BNDA	Loans to village associations having joint responsibility with the ODRs: CMDT, Office du Niger, OHV, ORM. Loans to major operators in the sector. Loans limited to individuals and cooperatives. Management of third-party risky lines of credit (project).
ODR	Future sales of inputs. Agricultural implements credit facilities.
Financial NGOs	Popular savings and lending institutions in cotton growing areas and the Dogon community. Cooperative credit foundation.
The Ségou DNA COOP-FIDA Village Development projects	Allocation of credit facilities through village banks after a compulsory savings scheme.
DNA COOP project	Promotion fund managed by some hundreds of village communities.
ARPON Projects and Pilot project DNA COOP-ACDI-FDV	Savings and credit bank. Village Associations equipment amortization fund. Procurements funds.

6.6.2 Agricultural Credit Availability/Accessibility

Despite the diversity of the sources mentioned, available credit facilities appear inadequate with regard to the requirements of the rural areas. As regards the BNDA, which provides the bulk of these credit facilities, the evolution of its agricultural lending during the period FY 1986/87 to FY 1989/90 is presented in Table 6.9.

Table 6.9. Mali: BNDA Agricultural Loans, 1986-90 (million FCFA)

Loans/Year	1986/87		1987/88		1988/89		1989/90	
	Number	Amount	Number	Amount	Number	Amount	Number	Amount
Joint Responsibility Loans								
Animal traction	856	539.4	711	437.7	538	256.5	674	425.5
Mechanized farming	58	87.1	36	41.1	19	49.0	-	-
Other credit to AVs								
Inputs	74	274.9	335	2,113.9	436	2,165.6	154	577.6
AV/harvests	531	427.8	370	200.9	469	334.2	456	348.9
Storage	512	736.5	106	113.5	994	758.6	481	462.3
Others	234	124.0	118	61.7	138	70.3	156	92.4
Artisans and blacksmiths	16	6.5	4	0.9	16	10.3	7	4.1
MAEE livestock	-	-	-	-	-	-	14	67.5
Farmers' livestock	12	7.3	24	32.8	5	10.4	48	97.8
Subtotal	2,293	2,203.6	1,704	3,002.5	615	3,654.9	1,990	2,076.1
Cooperative sector loans	117	183.6	4	11.3	272	462.2	40	78.8
Direct credits	113	255.1	28	75.4	233	87.3	11	98.9
Company credits	7	6,807.0	5	6,815.0	4	7,709.0	5	12,043.0
Grand Total	2,530	9,449.3	1,741	9,905.2	114	11,913.3	2,046	14,296.9

Source: BNDA Reports for FY 1988/89 (March 1990) and FY 1989/90 (April 1991)

This table highlights an increase in the number and volume of the collective credit facility (with joint-responsibility) granted in the rural area. The decline in grants for inputs, the level of which was only 600 million in 1989/1990, was reportedly due to problems encountered by the AVs, such as the difficulty in separating procurement from lending operations, as well as the actual high costs of monitoring the credit facilities granted.

It should be stressed that access to agricultural credit facilities appears very limited to farmers who are not among the target groups of ODRs and other projects. These farmers in the "zones diffuses" or zones not covered by ODRs depend mainly on private traders for their short-term credit.

6.6.3 Forms of Credit Facilities and Condition

Agricultural credit facilities are granted on a short-term basis for chemical inputs (farming season credits) and on a medium-term basis for implements (2-4 years). For the joint-responsibility bank loans (BNDA), the ODRs play an advisory role with respect to AVs using credit facilities. The existence of this advisory unit is a guarantee of the viability of the operations being financed. Without this guarantee, the bank does not assume responsibility for the risk entailed in the loan.

In addition, AVs must have agriculture as the main activity and operate an account with the BNDA. A complete set of documents on the level of the organization's debt, its managerial and technical expertise, and monitoring capacity are also required.

In general, ODRs' conditions are similar to those applied by the projects providing direct credit facilities from their own resources. These institutions, however, remain less flexible in their operations because they are not subject to banking regulations.

6.6.4 Interest Rates on Agricultural Credit

The interest rates on BNDA's credit facilities are those of the BCEAO discount rate increased by a 2%-3% percentage points according to the type of credit facility. The BCEAO discount rate rose from 8.5% in 1987 to 11% in 1991. BNDA credit facilities with joint responsibility are, in addition, increased by 1% in order to provide resources for a death insurance fund for beneficiary farmers.

The interest rates on BNDA inputs and implements loans as compared with those of the ODR and/or other projects in 1991 are presented in Table 6.10.

Table 6.10. Mali: Interest Rates on Short- and Medium-Term Agricultural Input Loans,[a] 1991

Type of Credit	Interest Rate (%)			Duration of Loan (Years)		
	BNDA	OHV	FDV (ARPON Project)	BNDA	OHV	FDV (ARPON Project)
Fertilizers and seeds	14	11.9	12	1	1	1
Agricultural implements	15	14	8	4	4	5

a. Loans for fertilizer and seed purchases are short-term (1 cropping season) and loans for purchases of agricultural implements are medium-term (2-5 cropping seasons).

Source: BNDA, OHV, and ARPON Project.

Bank interest rates appear to be higher than those applied by agricultural development institutions for loans granted over similar periods. However, a disparity is noted in the lending and subsidy conditions among the development institutions depending on their source of funding. Thus, depending on the repayment rates, a discount of not more

than 2% is granted the beneficiary grouping by the ARPON Project (Amélioration de la Riziculture Paysanne de l'Office du Niger) funded from free assistance provided by the Netherlands.

6.7 Environmental Policy

6.7.1 General Framework of Environmental Policy

The general framework of the environmental policy is defined by the National Desertification Control Program, which was initiated in 1987 and which, in fact, comprises eight subprograms. The strategic framework for implementing the environmental resource management program was drawn up in 1991 on the basis of a pilot project on the preparation of the "Territorial Development schedule" launched between 1987 and 1991. The "village resource management" approach is the grassroots equivalent of the new National Resource Management Philosophy. This consists in using a package of methods and resources that will enable a rural community to express its developmental strategies through activities aimed at maintaining the operational capital while improving the community's living conditions. The enlightenment of rural communities "on the dangers of the current degradation of natural resources" constitutes the most important aspect of the village resource management approach to the Fertilizer Utilization Policy. Indeed, a major consequence of this natural resource degradation phenomenon (which is due to both physical and socioeconomic factors) is the intensification of soil erosion and hence a decline in soil fertility.

6.7.2 Components of Production and Soil Policy

6.7.2.1 Erosion Control

The quantity of soil nutrients lost as a result of erosion makes erosion control a priority aspect of the environmental protection and rehabilitation policy. Although farmers know and traditionally apply some simple soil conservation techniques, the model prepared by the IER research system in 1980 extensively includes the village resource management approach.

This model comprises:

- Water and diversion drainage projects, which include belt drains, outlets, and drainage dikes.
- Run-off control projects, stone cordon, control bays, and grassed strips.
- Entrenching the protection systems through tree planting on farm edges, the reintroduction of trees in farms.
- Adapted cultural practices such as dry harrowing, organic manure utilization, and tied ridges.[23]

The ultimate stage of ensuring the model's success consists in the development of areas located up the farms through reforestation activities and the control of grazing and tree cutting.

6.7.2.2 Promotion of Fertilizer Utilization

In addition to the erosion control activities, the promotion of fertilizer utilization constitutes another priority aspect of the environmental soil fertility restoration policy.

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[23]Source: *Schema Directeur du Secteur Développement Rural, Mai 1992.*

Several socioeconomic constraints currently limit the use by farmers of fertilizer dosages recommended by research and popularized by the development institutions. In light of these constraints, on-going research work and activities aimed at an effective utilization of locally produced fertilizers should be strengthened.

6.8 Agricultural Research and Extension Policy

6.8.1 Research

Current agricultural research policy centers on the establishment of an effective and efficient system for planning and programming research activity. This policy is reflected in a recently established long-term strategy characterized by a better orientation of research work to the country's priority developmental problems and an acknowledgment of farmers' socioeconomic and technological constraints. It also calls for the decentralization of research activity to a network of regional institutions to take effective account of local conditions and enhance farmers' access to extension institutions. The strategic plan, in addition, addresses problems relating to technology transfer, intra-research relation, and inter-research and partner links (upstream and downstream) through the intensification of out-station operations and the establishment of a consultation framework around the programs.

It has been planned that henceforth internal relations and technology transfer will be included in any innovation creation process undertaken by the research station.

At the same time, the participation of research workers in multilocation trials and pre-extension work will be strengthened. The various consultation frameworks among research partners, must help to develop direct contact, facilitate the adoption of users' requirements into research objectives, and encourage the introduction, monitoring and evaluation of technologies transferred to farming communities.

6.8.2 Extension Work

Since 1967, the agricultural development policy has been based on an integrated approach geared towards the regionalization of investment programs through ODRs. These institutions, considered an adequate response to development problems, helped to cover the country with an agricultural extension service network, the intensity of which varied from region to region. Beyond the areas covered by ODRs, which for the most part enjoyed external funding (some of which perpetuate their activity), extension service is provided by the traditional institutions of the Direction Nationale de l'Agriculture in the so-called "scattered areas" where the scope of the extension work is very limited in view of national budgetary constraints.

The current agricultural extension policy defined by the recent National Agricultural Extension Program focuses on these "scattered" zones while coordinating and improving the extension network in areas where extension work is already effective. The World Bank-financed project adopted a method derived from the "Training and Visit" approach. In Mali's case, it encouraged the organization of farmers by dealing with village associations where they existed and supporting their creation in localities that did not have them. The long-term objective of this agricultural extension policy funded under the current structural adjustment program is to divide the recurrent expenses on agricultural extension work between the Government and farmers' communities in the villages. The agricultural extension scheme should also enable farmers to gradually assume responsibility for these operations in order to undertake a number of farming-related activities such as inputs procurement.

6.8.3 Funding of Research and Extension Work

The current level of research funding averaged 2,244 million FCFA annually during the past 3 years. Of this amount, national budget appropriations are estimated at 866 million FCFA. The rest comes from donors. This amount, which covers about 39% of research work, is primarily meant for salaries of locally recruited staff and accounts for 0.3% of the GDP.

The overall funding for research activities is difficult to estimate in view of the extremely diverse sources of financing from the World Bank project, NGOs, ODRs, and other developmental projects.

Chapter 7

Summary and Conclusions

Mali's population increased from 4.1 million in 1960 to 8.1 million in 1990 and is expected to reach 9.7 million in the year 2000. This growth in population and the expected growth in per capita income will put pressure on Mali's limited land resources to produce increasing amounts of food, fiber, and fuel to meet the growing demand. In addition, the past growth in population and the practice of shifting cultivation have intensified the problem of soil degradation and desertification. Unless efforts are made to control soil erosion through proper nutrient management, water harnessing, and other measures, the resource degradation will become an intractable problem. Hence, efficient and environmentally sound fertilizer use will play an important role in providing increased crop production and in preserving the resource base.

The main objective of this study is to analyze the role the policy environment has played in promoting growth in fertilizer use and supply in Mali and to identify policy-related factors constraining the fertilizer sector operations. As a corollary, the study also suggests measures to remove policy-related constraints.

For the purposes of this study, the policy environment was defined as comprising seven policies, namely, macro, pricing and subsidy, credit, research and extension, environmental, organizational, and supply. Only the selected components of each policy having direct and indirect impact on the fertilizer sector operations are analyzed.

Lack of consistent and reliable data was a major problem in the completion of this study. Developing adequate institutional arrangements for collecting, processing, and

maintaining data on various facets of the fertilizer sector development should receive a high priority in future work.

Fertilizer use grew at 17.7% per annum during the 1970s and 4.9% per annum during the 1980s. In absolute amounts, total fertilizer use was 2,547 nutrient tons in 1970, 14,928 nutrient tons in 1980, and 24,470 nutrient tons in 1990.

Although total fertilizer use increased at 4.9% per annum during the 1980s, there was little growth in per-hectare fertilizer use, which increased from 8.0 kg/ha in 1980 to 8.7 kg/ha in 1990. Thus, means most of the growth in total fertilizer use was due to increase in fertilized area.

Mali's agricultural and rural development activities are designed and implemented through integrated rural development agencies known as "Opérations du Développement Rurale" (ODRs). Hence, five ODRs, namely, CMDT, OHV, ON, ORM, and DRA-M, were selected to analyze the impact of the policy environment on fertilizer sector development in Mali.

Fertilizer use in Mali is highly concentrated in a few ODRs. In 1990, CMDT accounted for 81% of total fertilizer use. ON and OHV accounted for 13% and 3%, respectively. Thus, these three ODRs accounted for over 95% of the total fertilizer use. Although these three ODRs cover most of the highly productive area of southern Mali, efforts are needed to promote fertilizer use in other parts of the country where the resource degradation problem is serious.

CMDT's dominant position in fertilizer use is an outcome of several factors including well-developed and integrated crop and input markets, adequate research and extension, and focus on export crops. Further, farmers in the CMDT zone have an assured market and

price for their produce. Such favorable conditions are generally not prevalent in other ODRs.

Mali's nutrient use is based on high-analysis fertilizers like DAP, urea, and NPKs (cotton formula). These three products accounted for over 90% of total nutrient use in 1990. In this respect, Mali is ahead of many other West African countries, including Ghana, who rely heavily on low-analysis fertilizer products.

The macroeconomic policy had not been as severe a constraint on fertilizer use in Mali as it had been in Ghana during the 1980s. Because Mali is a member of West African Monetary Union, its currency is easily accepted in most of West Africa and France. Also, Mali had been importing fertilizers from Senegal and Côte d'Ivoire where the currency is FCFA as it is in Mali. Nevertheless, foreign aid has played an important role in supplying fertilizers.

Fertilizer use was subsidized in the 1970s. However, fertilizer subsidies have been phased out as a part of structural adjustment programs. Very few subsidies were in existence in 1990. Only local phosphate rock was subsidized.

Although Mali has good-quality phosphate rock (TPR) suitable for direct application, the TPR has not become popular with the farmers. To promote its use, CMDT subsidizes its price by 60%. Factors constraining direct application of TPR and its economic feasibility should be explored in the future research.

Nominal prices of both crops and fertilizers have increased over time. However, because of removal of subsidies and decrease in crop prices, real prices of fertilizers (terms of trade) have increased. Real prices of all nutrients were higher in 1990 than they were in 1980 for all crops except paddy rice.

Mali's pricing policy ensured subsidized and uniform prices throughout the country. However, this policy was changed in the 1980s. Consequently, prices differ from one zone to the other. For example, nominal and real prices of fertilizers were much lower in the CMDT zone than in other ODRs. This is mostly because CMDT benefits from the economies of scale in purchasing its fertilizer requirements.

Until 1980, SCAER was responsible for importing fertilizers for all ODRs. Because of mounting losses and deficits, SCAER was dissolved in 1980-81. Thereafter, all ODRs arranged for their fertilizer imports. This change in policy has created opportunities for some private agencies like COMADIS to import and distribute fertilizers. In some of the ODRs, village associations have assumed the responsibility of distributing fertilizers.

Credit for purchasing fertilizers is provided by both ODRs and BNDA at an interest rate of 10%-14% per year. Because many ODRs promote trade-in-kind, i.e., exchanging fertilizers for crop produce, most of the loans for fertilizers are only for one cropping season. At the farm level in the CMDT zone, credit does not seem to be a constraint. However, further research is needed in this area.

Mali has not created any inefficient fertilizer production facilities, nor has it built protective walls to safeguard and promote the use of TPR. However, Mali should explore the possibility of using TPR in blending and compaction operations. The use of TPR should also be encouraged to restore and maintain soil fertility at reasonable levels so that soils do not become degraded. Mali's environmental policy seems to be moving in the right direction in this area.

Outside the CMDT zone, and in other parts of the country not covered by the ODRs (known as "zones diffuses"), research and extension efforts should be strengthened.

Currently, there is no policy in existence to promote the development of private sector dealer networks for fertilizer marketing and distribution. Institutional and infrastructural facilities should be developed to train dealers in the fertilizer business.

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