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ABSTRACT

AN ECONOMIC ANALYSIS OF COTTON
PRODUCTION, MARKETING AND PROCESSING
IN NORTHERN ZAIRE

By

Eric Frans Tollens

Presently, cotton production in northern Zaire is less than half the 1960 level when Zaire gained independence from Belgium. Production has declined because of a reduction in the number of cotton farmers, cotton acreage per farm and reduced yields per hectare.

The Government of Zaire is now committed to develop northern Zaire based on agricultural and industrial development of the third growth pole centered in Kisangani. Cotton production will play an important role in a comprehensive strategy for developing the rural areas as ecological conditions favor the production of cotton and domestic and export demand is favorable for cotton lint.

The purpose of this study is to describe the cotton subsector in northern Zaire, identify barriers to expanding cotton production, evaluate alternative strategies for increasing cotton production and formulate policy prescriptions for expanding cotton production and for improving the performance of the cotton marketing system. This study utilizes the concept of a subsector study and focuses on cotton production, marketing and processing in northern Zaire, including both the vertical and horizontal relationships for this subsector.

The major features of the agricultural economy in Zaire were reviewed and the essential economic characteristics of the cotton subsector in northern Zaire and of its environment were described in order to understand how the subsector operates. A farm business survey of 160 randomly selected cotton farmers was conducted in northern Zaire over the 1972-1973 cotton production year. Enumerators visited each farm twice a year, once before harvest and once after harvest. The survey generated information on the characteristics of cotton farmers, cotton production practices, the "crop imposition system," the agricultural extension service, farm size, yields, incomes, marketing of seed cotton, and the major constraints on expanding cotton production.

The survey of 160 cotton farmers revealed that seed cotton yields were low, 399 kg. per hectare, cotton acreage per farm was 0.36 hectares, and the gross income per farm from cotton production was 8.79 Zaires (17.58 dollars). There was a large variation in cotton acreages and yields between farms. Generally, farmers were not following simple but recommended agronomic practices such as time of planting, spacing, etc. In addition, there were no farmers in the survey using chemical fertilizers, pesticides, tractor mechanization or agricultural credit. However, some cotton fields were treated with insecticides by the agricultural service of ONAFITEX, the national cotton marketing office.

An analysis of the returns to labor for cotton and for other selected commodities in northern Zaire revealed that the returns for cotton were comparable with those for the major food crops but were below the legal minimum wage of unskilled workers in rural areas. The returns for perennial crops, cocoa, coffee and oil palm, were more than three times higher than for cotton and were well above the legal minimum wage.

A multiple linear regression model was used to explain the variation in cotton yields and in cotton acreages between farms. Dummy variables representing the major differences in ecological conditions and in agronomic practices between the four subregions in the North were among the most important variables explaining the differences in cotton production between farms in northern Zaire.

Alternative strategies for increasing cotton production in the North were analyzed and evaluated. These strategies must be examined in the context of increasing regional commodity specialization within northern Zaire and in a political economy framework of developing the North. In the immediate future, the most promising avenues for expanding cotton production are a revision of cotton pricing policies, diffusion of improved agronomic practices, an overhaul of the cotton extension service, a pilot cotton development project in Bas-Uélé, and accelerated research on new varieties.

Although the government has raised the producer price of seed cotton a number of times since independence, the real purchasing power of seed cotton in December, 1973 was only about half the June 1960 level. Local fiber prices are kept low to protect the Zairean textile industry and Zairean consumers. A substantial increase in the price from 6.5 Makuta to 10.0 Makuta per kg. for the first grade seed cotton is needed to provide adequate incentives for farmers to expand cotton production. An increase in the domestic lint price of 15 to 20 K. per kg. would generate enough revenue to enable ONAFITEX to raise the producer price.

A price increase of 15 to 28K. per kg. of cotton lint for domestic spinners would raise the price of domestic lint to about 60 to 65K. per kg. of lint, still well below the price they would have to pay for imports of the same quality and grade. Higher producer prices would, in turn, reduce per unit cotton marketing and processing costs and will provide ONAFITEX with substantial export earnings. When more favorable producer pricing policies are adopted, the cotton "imposition system" can be removed and the cotton extension service can gradually shift from its traditional regulatory role to an educational level.

There is a large opportunity for increasing cotton yields in northern Zaire by introducing improved agronomic practices. However, a major overhaul of the cotton extension service is needed in order to create the administrative structure and leadership for effective small farmer extension programs. Extension reforms include retraining and upgrading of extension workers, creation of regional cotton extension committees and the establishment of an extension department at the National University of Zaire and at the National Institute for Agronomic Studies and Research. Extension agents should focus on assisting farmers in adopting simple agronomic practices such as timely planting and harvesting, correct spacing, frequent thinning and weeding, etc. We also recommend that the extension service encourage farmers to purchase locally made hand powered sprayers or dusters. Farmers should be taught how to protect their crops from cotton pests instead of relying on the cotton extension service to apply pesticides to their fields.

There is a strong case for establishing a pilot cotton development project in Bas-Uélé, centered in Bambesa. Such a project, focusing on

an extension of improved agronomic practices, would have a great potential for increasing cotton production. Moreover, specialization of production in this area would substantially reduce per unit assembly, transport and ginning costs.

Research on new varieties for the North should also be accelerated and improved varieties should be imported from neighboring countries. Chemical fertilizers, tractor mechanization and agricultural credit are less promising strategies for increasing cotton production in northern Zaire in the immediate future. More technical and economic research is needed at the farm level to determine the profitability of alternative rates of fertilizer application, selective mechanization and agricultural credit. When the cotton producer's price is raised and when the extension service is upgraded, these strategies may become feasible.

AN ECONOMIC ANALYSIS OF COTTON PRODUCTION, MARKETING AND PROCESSING IN NORTHERN ZAIRE

By

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LIST OF WEIGHTS AND MEASURES, CURRENCY EQUIVALENTS, ABBREVIATIONS AND ADMINISTRATIVE ORGANIZATION OF ZAIRE

1. Weights and Measures

1 hectare (ha.) = 2.471054 acres
1 hectare (ha.) = 100 ares - 10,000 square meter
1 kilometer (km.) = 0.621371 mile
1 meter (m.) = 3.28084 feet
1 kilogram (kg.) = 2.204623 pounds
1 gram (g.) = 0.035274 ounce
1 metric ton (ton) = 2,204.6 pounds = 1.10231 short tons = 0.984207 long ton
1 leter (l.) = 0.264178 gallon

Temperatures are given in Celsius degrees.

2. Currency Equivalents

--Before November 6, 1971:
50 Congolese francs (FC) = 1 US$

--From November 9, 1963 to June 23, 1967:
180 Congolese francs (FC) (selling rate) = 1 US$
150 Conglese francs (FC) (buying rate) = 1 US$

--After June 23, 1967:
1 Zaire (Z) = 1,000 Conglese francs (FC) = 0.50 US$
1 Zaire (Z) = 100 Makuta (K) (unit Likuta, plural Makuta)
1 Likuta (K) = 100 Senghi (S)

3. Abbreviations

ONAFITEX (Office National des Fibres Textiles): National Office for Textile Fibers
UNAZA (Universite Nationale du Zaire): National University of Zaire
INERA (Institut National d'Etude et de Recherche Agronomique): National Institute for Agronomic Studies and Research
ONRD (Office National de la Recherche et du Developpement): National Office for Research and Development
IRES (Institute de Recherches Economiques et Sociales): Institute for Economic and Social Research
FED (Fonds Europeen de Developpement): European Development Fund
USAID: United States Agency for International Development
CFDT (Compagnie Francaise pour le Developpement des Fibres Textiles): French Company for the Development of Textile Fibers

IRCT (Institut de Recherches du Coton dt des Textiles Exotiques): Research Institute for Cotton and Exotic Textiles
CAK (Commission Agricole du Kasai): Agricultural Commission of Kasai
ONATRA (Office National des Transports): National Transport Office
COGERCO (Comite de Gerance de la Caisse de Reserve Cotonniere): Management Committee of the Cotton Reserve Fund
COVENCO (Comptoir des Ventes de Coton): Cotton Sales Agency
SOFIDE (Societe Financiere de Developpement): Financial Development Company
SOFIDAG (Societe Financiere de Developpement Agricole): Financial Agricultural Development Company
CADEZA (Caisse Generale d'Epargne du Zaire): General Savings Fund of Zaire

4. Administrative Organization of Zaire

--Before 1972: the country was divided into provinces, each province into districts, each district into territories, each territory into sectors and each sector into villages.

--Since 1972: The country has been divided into regions, each region into sub-regions, each sub-region into zones, each zone into local collectivities and each local collectivity into localities.

--The Department of Agriculture, previously called the Ministry of Agriculture, is headed by the State Commissioner for Agriculture, formerly called the Minister of Agriculture, while the civil service is headed by a Director-General who was previously called Secretary-General.

5. Miscellaneous

In the Tables:

--A long dash (---) indicates zero or less than half the unit shown, or the nonexistence of the item.
--Dots (...) indicate that the data are not available.

In the Tables and Text:

--A slash between years (1972/1973) indicates a single fiscal or crop year.

--A short dash (1972-1973) indicates a period of two or more years, though not necessarily claendar years.

CHAPTER I

INTRODUCTION

Problem Setting and Importance of the Study

The Republic of Zaire, situated in the heart of Tropical Africa, gained independence from Belgium in 1960.[1] The first five years of independence were characterized by civil and political disorders and disruption of the economy. The country recovered slowly after 1965 and is presently engaged in an active period of "nation building." A map of the administrative divisions in Zaire is presented on the next page.

Some 21 million people live in an area one-third the size of the United States. Only 1.2 percent of the total land area is under cultivation in annual field crops and tree crops. About half the land is classified as arable. Shifting cultivation and intercropping are the typical methods of farming. About 30 percent of the population is urban and the proportion is rapidly increasing because of rural to urban migration and higher birth rates in the cities.

The Zairean economy is well diversified compared with that of other African countries. Agricultural exports made up 16.7 percent of total exports in 1972 compared with 40 percent in 1958. Zaire generates considerable foreign exchange earnings from a variety of minerals, in

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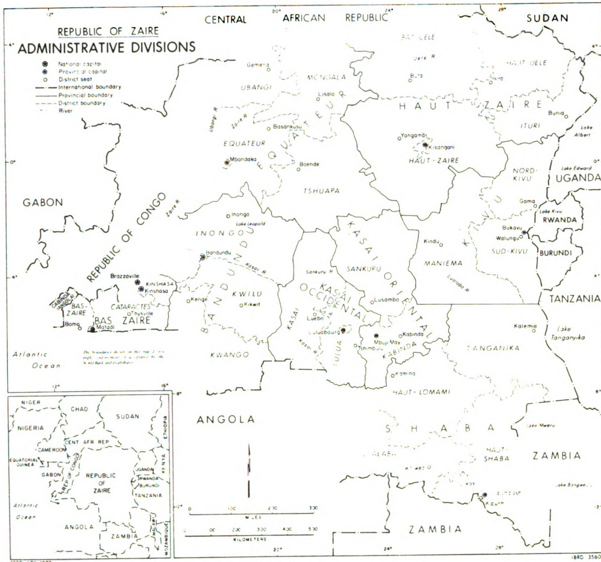
[1]The Democratic Republic of the Congo changed its name to the Republic of Zaire in October 1971.


REPUBLIC OF ZAIRE
ADMINISTRATIVE DIVISIONS
National capital
Provincial capital
District seat
International boundary
Provincial boundary
District boundary
River
CENTRAL AFRICAN REPUBLIC
SUDAN
UGANDA
RWANDA
BURUNDI
TANZANIA
ZAMBIA
ANGOLA
GABON
REPUBLIC OF CONGO
Atlantic Ocean
HAUT-ZAIRE
EQUATEUR
BANDUNDU
KASAI ORIENTAL
KASAI OCCIDENTAL
KIVU
SHABA
BAS ZAIRE
KINSHASA
Kinshasa
Brazzaville
Matadi
Boma
Thysville
CATARACTES
Mbandaka
Kisangani
Bandundu
Bukavu
Luluabourg
Mbuji-May
Goma
Kindu
Kalemie
Kamina
Kenge
Kikwit
Inongo
Boende
Basankusu
Lisala
Gemena
Yangambi
Buta
Isiro
Bunia
Lusambo
Luebo
Tshimbulu
Kabinda
Walungu
UBANGI
MONGALA
TSHUAPA
ITURI
NORD-KIVU
SUD-KIVU
MANIEMA
SANKURU
TANGANIKA
HAUT-LOMAMI
HAUT-SHABA
KWILU
KWANGO
INONGO
KASAI
LULUA
KABINDA
Lake Albert
Lake Edward
Lake Kivu
Lake Tanganyika
Lake Mweru
Lake Leopold
Zaire R.
Ubangi R.
Uele R.
Kasai R.
Sankuru R.
Lualaba R.
MILES
KILOMETERS
NIGER
NIGERIA
CHAD
CAMEROON
EQUATORIAL GUINEA
CENT AFR REP
REP OF CONGO
REPUBLIC OF ZAIRE
ETHIOPIA
KENYA
MALAWI
MOZAMBIQUE
FEBRUARY 1972
IBRD 3560R2

Map 1.

particular, copper, which accounts for about 60 percent in value of total commodity exports.[2]

Agricultural exports come mainly from large plantations with the exception of cotton which is exclusively grown by smallholders. In fact, for many Zairean farmers, cotton is the only cash crop. In 1957 cotton made up nearly 80 percent of the export crop receipts of Zairean farmers.

In the 1930s the colonial administration introduced paysannats or farm settlement schemes which permitted close supervision and diffusion of new technology. About 180,000 farmers were organized in the paysannat system in which cotton was the main cash crop. In 1956 paysannats produced 27 percent of the total cotton crop. At the end of the colonial administration in 1960, about 800,000 families cultivated cotton, producing 63,000 tons of cotton fiber; 53,000 tons were exported and 10,000 tons were absorbed by domestic textile mills. Cotton fiber exports constituted 12.5 percent of the value of all agricultural exports and 5.2 percent of the value of total exports. After independence, however, the paysannat system broke down during civil disorders and increasing marketing costs, corruption and disorganization of the extenion service and a rapidly deteriorating transportation system explain the drastic decline in cotton production after 1960 (Table 1.1). In 1965, seed cotton production amounted only to 10 percent of the 1959 level, and from 1965 to 1968 Zaire had to import considerable quantities of cotton fiber and textiles to supply domestic needs. Then in 1969, with the return of security and stability, seed cotton production

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[2]Recently, off-shore petroleum reserves have been discovered.

Table 1.1. Republic of Zaire: Production, Exports and Imports of Cotton Fiber (in Tons[1])

Year	Production	Exports	Imports	Internal Consumption
1959	59,280	52,790	0	6,490
1960	46,230	41,504	450	5,176
1961	21,328	17,180	0	4,148
1962	12,828	9,807	690	3,711
1963	14,130	9,126	516	5,520
1964	13,270	3,142	0	10,128
1965	6,158	190	9,220	15,188
1966	6,587	0	5,320	11,907
1967	8,220	0	5,880	14,100
1968	13,700	15	1,671	15,356
1969	17,050	7,183	0	9,867
1970	17,250	8,855	0	8,395
1971	19,930	5,056	0	13,874
1972	16,114	4,465	0	11,649
1973	22,000	6,127	0	15,873
1974	22,000*	3,080*	0	18,920*

*Estimation.

[1]Ministère de l'Agriculture et du Développement Rural, April 1970. Rapport Préliminaire 1959-1969. Kinshasa: Direction Etudes et Politique Agricole: République du Zaire, November 1973. Conjoncture Economique, Année 1972 et 1er Trimestre 1973. Kinshasa: Ministère de l'Economie Nationale, Nr. 13 and ONAFITEX: Direction Commerciale.

started increasing. In 1973 the production of seed cotton was estimated at 66,915 tons with 22,000 tons of fiber from which only 6,127 tons were exported (Table 1.1). This represents nearly 3.5 million Zaires in cash income for farmers. An estimated 500,000 families now grow cotton on about 200,000 hectares. Yet, only hand-farming methods are practiced and almost no improved inputs are used except seed. Very few capital goods are utilized.

Still, domestic consumption of cotton fiber is increasing and external demand is very strong. Therefore, an increase in cotton production is a top priority for the Zairean government. In 1971 a cotton marketing office, "ONAFITEX", was created with full responsibility for the buying, transportation, ginning and sale of cotton and cotton by-products.[3] This office served as a model for nine other product marketing offices which have been recently created.

There are few African countries where the need for relevant agricultural economics research is so acute as in the Republic of Zaire. Historically, development strategies and policies in Zaire have focused on the creation of an industrial, export oriented sector, and relatively minor attention has been given to agriculture and rural development [Nasse, et al., 1973]. Furthermore, when agricultural development has been promoted, there has often been a tendency to emphasize large schemes, plantation farming and farm and educational systems from foreign countries which are incompatible with the social organization and culture of most traditional Zairean farmers.

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[3]ONAFITEX (Office National des Fibres Textiles): the National Office for Textile Fibers is a marketing office created by the government with monopoly rights for cotton processing and marketing.

Recent experience in numerous African countries, however, has demonstrated that an industrial/urban-led strategy of development is unlikely to provide sufficient jobs, equitable urban-rural income distribution and opportunities for the bulk of the population who are in agriculture to purchase improved diets and consumer goods from the industrial sector [Byerlee and Eicher, 1972]. In Zaire a new agricultural policy is required to cope with large imports of major foodgrains (maize, rice) and meat, rural to urban migration, urban unemployment, large urban-rural income differentials and to improve the income opportunities of the rural population.

Yet although self-sufficiency in food and fiber is a top priority,[4] the country has only a few agricultural economists to guide policy makers. The Department of Agriculture, with the support of USAID recently established an Agricultural Economics Research Bureau. With the reorganization of higher education in Zaire in 1971, there is now one national university with three main campuses [Rideout, 1974]. The Faculties of Agronomy moved from the capital city of Kinshasa and from Lubumbashi and Kisangani to Yangambi (60 miles west of the main Kisangani Campus), the headquarters of the National Institute of Agronomic Studies and Research (INERA).[5]

Despite such positive steps, the Zairean capacity for agricultural economics research and agricultural planning is at present very limited, with only one Zairean Ph.D. in agricultural economics in the country.

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[4]A popular slogan is: "Indépendance du Ventre" or "Independence of the Belly."

[5]INERA (Institut National d'Etude et de Recherche Agronomique) was created in 1970 and replaced INEAC (Institut National Pour l'Etude Agronomique du Congo): The National Institute for Agronomic Studies of the Congo.

However, several Zairean students are now undertaking overseas graduate studies in agricultural economics at the doctoral level. Furthermore, the government is aware of the need to focus greater attention on agriculture and has declared "agriculture the priority of priorities."[6] But though the specific objectives for agricultural development are now clearly defined, most of these are conflicting. Indeed, no one coherent agricultural policy has been established in Zaire although several agricultural policies are being formulated, such as the recent creation of an agricultural development bank (SOFIDAG). Still, more research in agricultural economics is urgently needed.[7] Priorities for specific research in agricultural economics are elaborated on in a forthcoming paper by the author [Tollens, 1975].

Research Approach and Scope of the Study

The author first visited Zaire from January 13 to March 13, 1971 in order to identify a thesis subject, a trip made possible by a grant from the Ford Foundation. The Director-General of the Department of Agriculture and his staff indicated that research on cotton was urgently needed. Cotton production was stagnating and the marketing operations required government subsidies to break even. The World Bank had just finished a pre-investment study of cotton production and marketing in the North and had postponed action until a number of institutional reforms were carried out. The lack of information on and analysis of

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[6] Speech by President Mobutu Sese Seko on December 5, 1972.

[7] In a workshop on the role of science and technology in the economic development of Zaire during the 1970s, organized jointly by the National Office for Research and Development (O.N.R.D.) in Zaire and the U.S. National Academy of Sciences from June 7-11, 1971, the field of agricultural economics was identified as a problem area requiring urgent attention.

the present and alternative production and marketing systems was cited as a major reason why investment decisions were postponed.

The author visited the Ubangi region in the North, toured cotton fields and ginneries and held discussions with regional Department of Agriculture officials and cotton marketing agents. A discussion with Department of Agriculture officials in Kinshasa revealed that in-depth village level studies in a small number of selected villages were not desired. Rather the Department of Agriculture preferred a study of the entire northern cotton zone with a diagnosis of the factors constraining cotton production and marketing. This area is north of the central basin equatorial rain forest and includes equatorial rain forest, savannah woodland, tree savannah and shrub savannah, its east to west distance is 800 miles; its north to south distance is 220 miles.

The author returned to Zaire on August 18, 1971 and accepted an appointment in the Department of Agricultural Economics, Faculty of Agronomy, National University of Zaire, Kinshasa Campus.[8] At this time, an extension of the original grant from the Ford Foundation permitted the organization of a farm business survey in the entire northern cotton belt.[9] One hundred sixty cotton farmers were selected for interviewing by three-stage random sampling. Four field enumerators were hired.

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[8]The contract was signed with the Universite Lovanium which subsequently changed its name to Universite de Kinshasa and to Universite Nationale du Zaire, Kinshasa Campus. In October 1973, the Faculty of Agronomy moved to Yangambi and now depends on the Kisangani Campus.

[9]Subsequent funding from an AID/Washington 211(d) grant with the Department of Agricultural Economics at Michigan State University helped to overcome cost overruns due to underestimated transportation costs and interviewing which took longer than originally planned.

Each enumerator interviewed 40 farmers twice a year, once during planting and once during the harvesting season.

With this farm business survey, socio-economic information on cotton farms was collected over the June 1972-May 1973 period. The research focused on the range of conditions and constraints found on traditional cotton farms.

Objectives of the Study

The objectives of this study are:

1. to describe the cotton subsector in northern Zaire, i.e., the characteristics of the participants, incentive system, resources used, dynamics of the system, and the vertical and horizontal coordinating institutions,
2. to identify the barriers to improved performance of the cotton subsector and in particular the constraints on expanding cotton production,
3. to formulate alternative strategies and institutional arrangements for improving the overall performance of the system, and
4. to provide ONAFITEX and the Department of Agriculture with relevant data and with prescriptions for improving the performance of the cotton subsector.

Conceptual Framework for Studying Cotton Production, Marketing and Processing in Northern Zaire

Traditional farm management studies or marketing studies focusing on a particular commodity usually concentrate on a particular aspect of the problem investigated. Such an approach is useful but fails to take into account the many aspects of a problem and the trade-offs involved in solving the problem.

This study is going to utilize the concept of a subsector study as outlined by Shaffer [March, 1970]; it focuses on cotton production, marketing and processing in northern Zaire, including both the vertical and horizontal relationships for this subsector. It differs from more traditional approaches in its scope and comprehensiveness but not in its methodology or analytical techniques used.

An important objective of this study will be to describe the essential economic characteristics of the subsector and of its environment in order to understand how the subsector operates. The major problems and, in particular, the barriers to improved performance will be identified and analyzed. Specific modifications in the organization and structure of the cotton subsector will be analyzed and the consequences will be predicted for the future. Policy prescriptions will be presented for increasing cotton production and for improving the performance of cotton marketing.

Since subsector studies are comprehensive in their nature and as this study is a one-man undertaking, several research questions could not be pursued. Future research needs are indicated at the end of this study.

CHAPTER II

AGRICULTURE IN THE ECONOMY OF ZAIRE

Recent Performance of the Agricultural Sector

Population

The 1958 population was 13.6 million and the rate of population growth was estimated at 2.3 percent. The 1970 census arrived at a total population of 21.6 million with an average overall growth rate of 4.2 percent since 1958.[1] This rate of growth is close to the physiological limit and it implies a doubling of the population in 16.65 years [Nzeza, 1971]. It is very likely that the 1970 official population estimate has an upward bias of about 2 to 3 million.

Since 1960 there has been a considerable increase of about 0.8 million in the foreign born population.[2] Moreover, it is estimated that 70 percent of the population of Zaire is rural, although between 1958 and 1970 the major cities doubled their population. The five major towns of Kinshasa, Lubumbashi, Kisangani, Kananga and Mbuyi-Mayi had less than 6 percent of the total population in 1958 compared with about 12 percent in 1970. The population of Kinshasa more than tripled during that period. The heavy rural to urban migration coupled with

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[1] The breakdown in population is 20.7 million Zaireans and 0.9 million foreigners.

[2] Largely due to immigration from the neighboring countries of Angola, Sudan, Rwanda and Brundi.

higher rates of natural increase in urban areas explain the urban population explosion.

The average overall population density is 9.2 persons per square km. (23.9 persons per square mile), but because of the uneven distribution, it is only about 2 persons per square km. (5.2 persons per square mile) in over half of the country. On the next page a map of the population density in Zaire is presented.

Land and Climate

The total area of Zaire is 234.5 million ha. (905,000 square miles), the third largest country in Africa. Approximately 2.0 percent of the total land area is cultivated or in permanent pasture, while forest covers 45 percent of the country.[3] More than half of the country consists of poor savannah, swamps, lakes, rivers and mountains. On the next page, a map of the natural vegetation in Zaire (after Lebrun) is presented. Land is abundantly available except in a few areas with high population density where land is becoming scarce.[4] In 1973 the Zairean government decided that all land now belongs to the State.

The country lies astride the Equator and the elevation ranges from sea level on the West Coast to over 2,000 meters in the eastern mountains of the Kivu. This difference explains the wide variety of climates, the multitude of soil types and the many different crops that

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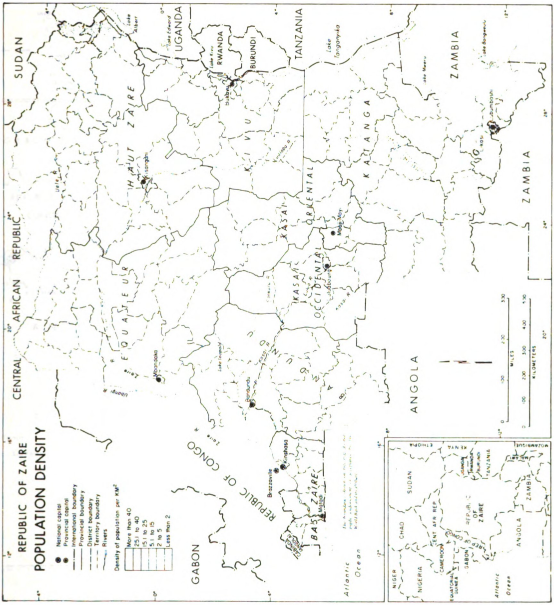
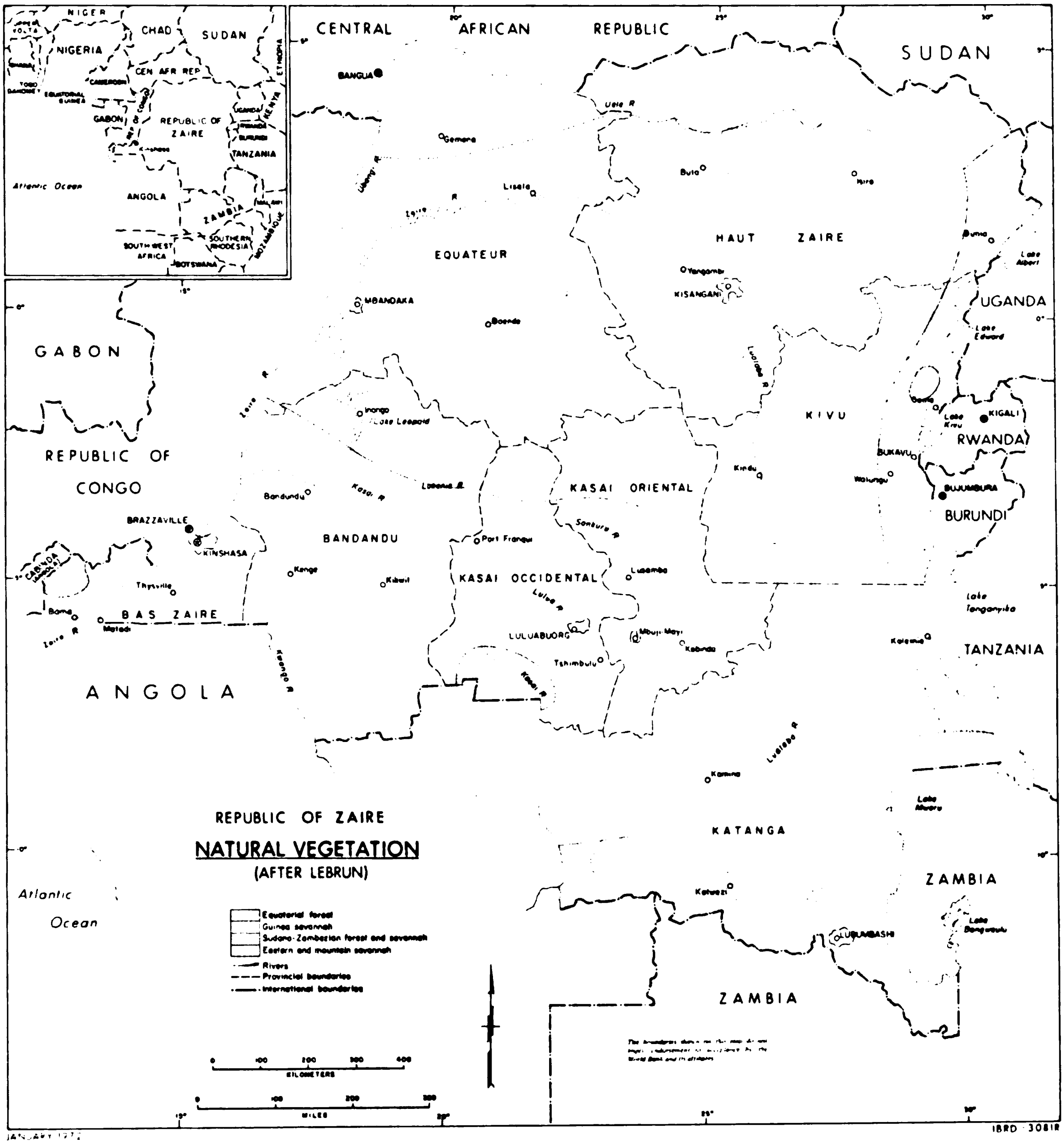
[3]An additional 15 to 20 percent of land was estimated to be under fallow in the late 1950s [American University, 1971].

[4]There are indications that in the most densely populated areas of Kwilu, East-Kivu and Bas-Zaire, land is becoming scarce as reflected in the rents charged by customary chiefs to new occupants and by the court cases over land titles in these regions.



REPUBLIC OF ZAIRE
POPULATION DENSITY
National capital
Provincial capital
International boundary
Provincial boundary
District boundary
Territory boundary
Rivers
Density of population per KM²
More than 40
25.1 to 40
15.1 to 25
5.1 to 15
2 to 5
Less than 2
CENTRAL AFRICAN REPUBLIC
SUDAN
UGANDA
RWANDA
BURUNDI
TANZANIA
ZAMBIA
ANGOLA
GABON
REPUBLIC OF CONGO
Lake Albert
Lake Edward
Lake Kivu
Lake Tanganyika
Lake Leopold
Lake Mweru
Lake Bangweulu
HAUT ZAIRE
EQUATEUR
KIVU
KASAI ORIENTAL
KASAI OCCIDENTAL
KATANGA
BANDUNDU
BAS ZAIRE
Kisangani
Bukavu
Mbandaka
Bandundu
Kinshasa
Brazzaville
Matadi
Mbuji-Mayi
Luluabourg
Lubumbashi
Atlantic Ocean
MILES
KILOMETERS
JANUARY 1972
IBRD-3524R

Map 2


REPUBLIC OF ZAIRE
NATURAL VEGETATION
(AFTER LEBRUN)
CENTRAL AFRICAN REPUBLIC
SUDAN
UGANDA
RWANDA
BURUNDI
TANZANIA
ZAMBIA
ANGOLA
GABON
REPUBLIC OF CONGO
Atlantic Ocean
HAUT ZAIRE
EQUATEUR
KIVU
KASAI ORIENTAL
KASAI OCCIDENTAL
BANDANDU
BAS ZAIRE
KATANGA
BANGUI
MBANDAKA
KISANGANI
BRAZZAVILLE
KINSHASA
LULUABOURG
BUKAVU
KIGALI
BUJUMBURA
LUBUMBASHI
CHAD
NIGERIA
REPUBLIC OF ZAIRE
TANZANIA
ANGOLA
IBRD 3081R

Map 3.

are cultivated. Generally speaking, the overall quality of the soils is average for tropical countries. Zaire is almost completely in the Guinean ecological zone.

Gross Domestic Product, Sources, Growth Rates and Agricultural Value Added

Perhaps the most important influence on the Zairean economy in recent years was the political crisis in the 1960s. All economic growth indices fell drastically from the 1959 levels and only in 1969 did they return to pre-independence levels.[5] Farm output fell sharply after 1960 as insecurity, unrest and rebellion spread through the country when Zaire gained independence from Belgium.

The Gross Domestic Product (GDP) was estimated at 1,014 million Zaires (Ƶ) ($2,028 million U.S.) in 1970 or 47Ƶ ($94) on a per capita basis. The economy of Zaire is divided in two basic sectors: the mining industry and agriculture. Cooper, cobalt and diamonds are the most important mineral resources, with the copper mining industry accounting for one-fifth of the GDP, practically two-thirds of total export earnings and one-half of government revenues.

The GDP grew at a rate of 5.4 percent in 1971, 4.5 percent in 1972 and 6.6 percent in 1973. These rates were in sharp contrast with rates of 9 to 10 percent experienced in 1969 and 1970.

The agricultural value added at current prices in 1972 was 15.3 percent at GDP, or 172.4 million Zaires. The share of commercial agricultural value added in GDP at market prices was 8.2 percent in 1972,

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[5] Except copper production indices which never fell drastically.

while the share of subsistence agriculture was 7.1 percent (Table 2.1). Services make up the largest part of GDP followed by trade, mining and metallurgy. Table 2.2 gives a breakdown of value added in agriculture, in agricultural exports, domestic nonfood crops and foodstuffs.

Structure of Agricultural Production and Marketing

It is important to point out the clear distinction between commercial and subsistence agriculture in Zaire. The commercial sector is dominated by plantations, many financed by Europeans, which are highly capital intensive and produce palm oil, coffee and rubber for export and sugar and livestock for domestic markets. Since December 1973 only Zairean nationals can own and operate the commerical agricultural plantations, ranches and farms. The subsistence sector, on the other hand, is made up primarily of traditional small land-holder farms, with usually less than one hectare under cultivation, cultivating food staples, manioc, rice, plantains, maize, beans and groundnuts in well established rotations. These operations are subsistence oriented but provide supplies of food staples to urban markets. The composition of agricultural production is illustrated in Table 2.3.

Total agricultural production increased rapidly from 1969-1970, but stagnated or even declined from 1970 on. This stagnation in production can be partially explained by reduced areas planted due to out-mirgation and serious drops in yields. Along with the rapid increase in population and the large migration to urban areas, such lagging agricultural production has created a serious gap between aggregate demand for farm products, especially food, and aggregate supply.

Table 2.1. Republic of Zaire: Composition of Gross Domestic Product, 1970-1972 (Value Added in Million Zaires at Current Prices)[1]

Composition of GDP	1970	1971	1972	Percent 1972
Commercialized Agriculture	79.1	82.6	91.0	8.2
Subsistence Agriculture	79.8	80.6	81.4	7.1
Mining and Metallurgy	211.5	152.0	162.7	14.3
Manufacturing	77.5	89.2	102.1	8.9
Construction and Public Works	30.0	39.4	33.6	2.9
Water and Electricity	8.7	9.5	9.6	0.8
Transport and Telecommunications	75.9	86.4	97.3	8.5
Trade	116.0	142.4	168.3	14.8
Services[2]	222.7	276.4	316.2	27.6
Banking (imputed)[3]	-4.8	-5.6	-5.7	-0.5
Import taxes	51.4	59.8	67.6	5.9
Noncommercialized Construction	15.0	19.7	16.7	1.5
Gross Domestic Product	962.8	1,032.4	1,140.8	100.0

[1] Banque du Zaire, December 1973. Rapport Annuel 1972-1973, Kinshasa, p. 68.

[2] Including government services

[3] Equal to the difference between interests received and interests paid by financial institutions.

Table 2.2. Republic of Zaire: Value Added in Commercial Agriculture, 1970-1972 (Current Prices in Million Zaires)[1]

Composition of Commercial Agriculture	1970	1971	1972	In %, 1972
A. Agricultural Exports	32.2	28.7	30.2	33.2
Oil Palm Products	11.7	9.8	5.0	5.5
Coffee	9.4	9.7	14.7	16.1
Rubber	4.1	3.0	3.1	3.4
Cotton	3.1	2.9	2.8	3.1
Timber	0.8	1.1	1.6	1.8
Tea	0.7	0.9	0.8	0.9
Cocoa	0.8	0.5	0.8	0.9
Other	1.6	0.8	1.4	1.5
B. Domestic Nonfood Crops	13.3	18.6	22.9	25.2
Oil Palm Products	3.0	3.5	3.0	3.3
Timber	2.6	2.5	2.7	3.0
Cotton	3.9	6.9	9.3	10.2
Other	3.8	5.7	7.9	8.7
C. Foodstuffs	33.6	35.3	37.9	41.6
Crops	22.8	24.2	26.6	29.2
Livestock	5.3	5.4	5.4	5.9
Fishing	5.5	5.7	5.9	6.5
Total	79.1	82.6	9.10	100.0

[1]Banque du Zaire, December 1973. Rapport Annuel 1972-1973, Kinshasa, p. 69.

Table 2.3. Republic of Zaire: Composition of Agricultural Production, 1969-1971 (Current Prices[1])

Composition of Agricultural Production	1969		1970		1971	
	Value (Million Zaires)	Percentage of Total	Value (Million Zaires)	Percentage of Total	Value (Million Zaires)	Percentage of Total
Commercialized Production	91.6	53.8	108.6	56.1	107.1	55.8
Crops	77.1	45.3	92.0	47.5		
Foodstuffs	25.1	14.7	27.3	14.1		
Export Crops	37.9	22.3	51.6	26.6		
Domestic Nonfood Crops	14.1	8.3	13.1	6.8		
Livestock and Fishing	14.5	8.5	16.6	8.6		
Subsistence Production	78.6	46.2	85.0	43.9	84.9	44.2
Total Output	170.2	100.0	193.6	100.0	192.0	100.0

[1]Banque du Zaire, December 1971. Rapport Annuel 1970-1971, Kinshasa, p. 75-76 and Banque du Zaire, December 1972. Rapport Annuel 1971-1972, Kinshasa, p. 60.

Note: The 1971 statistical tables of the Bank of Zaire do not permit any further breakdown. The 1972 tables express the statistics in value-added terms.

The marketing system consists primarily of small-scale traders operating at primary and wholesale levels with extreme fragmentation at the retail level. The serious deteriation of the transport network, especially since independence, and high storage and handling losses contribute to the very high distribution margins. At the end of 1973 nine agricultural product marketing offices were created along the lines of the cotton marketing office (ONAFITEX) with broad responsibilities for the production and marketing of the principal food and export crops.

Agricultural Exports and Imports

In 1959, agricultural exports accounted for 39 percent of total exports while in 1972, they had dropped to 17 percent. They increased in value rapidly between 1968 and 1970, and then stabilized in 1971 at about 60 million Zaires (Table 2.4), a stabilization attributable to the drop in world prices for the main export crops. Coffee, palm oil, rubber, forest products, cotton, tea and cocoa are the principal export crops. Over the 1965-1972 period, oil palm exports declined rapidly, while rubber exports decreased slowly and coffee exports increased as shown in Table 2.5. Note that only the exports of coffee are above the pre-1960 level.

In recent years Zaire has been a net importer of several major food products (Table 2.6). The portion of food imports in total imports increased from 14.8 percent in 1970 to 17.6 percent in 1972. Imports of foodgrains are increasing, especially maize and rice. In fact, the Department of Economics in Zaire estimates that maize production has to increase at an annual rate of 6 percent to keep up with increasing demand. Zaire also imports sugar, meat and fish. Fish being the most important animal protein source.

Imports of supplies and equipment for agricultural development are also increasing, as shown in Table 2.7, but do not reach 3 percent of the value of all imports.

Table 2.4. Republic of Zaire: Exports, 1968-1972 (In Million Zaires[1])

Exports	1968	1969	1970	1971	1972
Agricultural Exports	46.9	41.5	61.5	63.7	57.6
Total Exports	298.5	336.6	400.4	348.2	345.7
Agricultural Exports as a Percentage of Total Exports	15.7	12.3	15.4	18.3	16.7

[1]République du Zaire, Novembre 1973. Conjoncture Economique, Année 1972 et Ier Trimestre 1973. Kinshasa: Ministère de l'Economie Nationale, Nr. 13, p. 14.

The Role of Government in Agricultural Development

Objectives for Agricultural Development and Planning

In December 1970 the government identified the following target variables for agricultural development:[6]

1. increasing agricultural incomes of farmers,
2. self-sufficiency in basic food products and in cotton and a diminishing of the country's dependence on meat imports,[7]
3. agricultural diversification to increase export opportunities,
4. creation and expansion of agricultural processing industries.

[6]Presentation by the Department of Agriculture to the Consultative Group of the World Bank, November 1973 in Lumpungu Kamanda, March 1974. "Les Problèmes Actuels de l'Economie Agricole Zairoise." Kinshasa: I.R.E.S., Séminaire sur le Développement Agricole du Zaire.

[7]If possible, to become an exporter of these products.

Table 2.5. Republic of Zaire: Agricultural Exports, 1965-1972 (In Million Zaires[1])

Agricultural Exports	1965	1968	1969	1970	1971	1972	Percent 1972
Palm Oil Products	12.9	22.0	13.1	19.6	19.1	13.8	24.0
Rubber	4.5	6.9	7.3	7.2	6.0	5.6	9.7
Coffee	8.6	12.3	12.8	23.5	24.6	28.0	48.6
Cocoa	0.6	1.4	1.4	1.5	1.3	1.1	1.9
Cotton and By-Products	---	---	3.4	5.7	4.2	2.3	4.0
Tea	0.9	0.9	1.0	1.5	1.8	2.3	4.0
Forest Products	3.0	2.4	2.3	1.7	2.2	2.9	5.0
Other Agricultural Products	1.0	1.0	0.2	0.8	4.5	1.6	2.8
Total Agricultural Exports	31.5	46.9	41.5	61.5	63.7	57.6	100.0

[1] Republique du Zaire, Novembre 1973. Conjoncture Economique, Année 1972 et Ier Trimestre 1973. Kinshasa: Ministère de l'Economie Nationale, Nr. 13, pp. 18-19.

Table 2.6. Republic of Zaire: Agricultural Imports, 1968-1973 (In Thousand Metric Tons[1])

Agricultural Imports	1968	1970	1971	1972	1973
Maize	57.7	87.5	107.0	108.5	138.5
Rice	17.7	24.2	25.0	30.0	. . .
Sugar	0.9	15.0	20.2	20.0	. . .
Beef	6.5	12.5	12.0	12.5	. . .
Fish & Fish Products	20.0	24.8	25.0	25.1	. . .
Wheat and Wheat Flour	49.4	83.5	85.0	77.4	. . .
Malt	. . .	37.3	. . .	. . .	. . .

[1] Republique du Zaire, Novembre 1973. Conjoncture Economique, Année 1972 et Ier Trimestre 1973. Kinshasa: Ministère de l'Economie Nationale, Nr. 13, pp. 52-54; Nassee, et al., 1973, 14-35; Banque du Zaire, December 1973. Rapport Annuel 1972-1973, Kinshasa, p. 80.

Table 2.7. Republic of Zaire: Imports of Agriculture, 1969-1971 (c.i.f. Values in Million Zaires[1])

Imports for Agriculture	1969	1970	1971
Supplies for Agriculture	1.7	2.5	4.5
Agricultural Equipment	2.9	3.1	3.1
Total	4.6	5.6	7.6
Total Imports in Zaire	197.6	267.8	309.6

[1]Nasse, et al., p. 14.

It is clear that trade-offs are involved in these target variables. However, the question of priorities for target variables remains unanswered.

Projections have been made on production and consumption for the major food and export crops and livestock over the 1971-1980 period in the ten year agricultural program [République Démocratique du Congo, Mai, 1971]. The department of Agriculture first prepared a five-year (1971-1975) program for presentation to the first meeting of the Consultative group of the World Bank in April 1971 and later expanded this into a ten-year (1970-1980) agricultural program. The main emphasis of this program is on production objectives. Other important issues and problems, however, such as price policies, agricultural research and extension, infrastructure, staff training, etc. are not covered.

Agriculture in the Government Budget

Although agriculture was declared the priority of the priorities in economic and social development in 1972 the expenditures for agriculture were less than 3 percent of total government expenditures as shown in Table 2.8. However, it should be noted that substantial expenditures on agriculture are incurred by other departments and agencies. For example, part of the appropriations for regional expenditures are devoted to agriculture[8] and road building and maintenance is the responsibility of a government agency, the "Office des Routes." In addition agricultural education is the responsibility of the Department of Education and agricultural research is financed directly from the Presidency.

Table 2.8. Republic of Zaire: Total Government Expenditures on Agriculture (Current and Investment Budget), 1968-1972 (In Thousand Zaires[1])

Government Expenditures	1968	1969	1970	1971	1972[2]
Agricultural Sector	2,247	5,244	3,650	4,501	7,512
Total Expenditures	195,229	265,132	326,951	347,643	316,379
Percentage of Agriculture in Total Expenditures	1.2	2.0	1.1	1.3	2.37

[1]Table 2.9 and compilations by the author.

[2]Only first half of 1972 for investment expenditures. For 1974 Agence Zaire Presse, the national press agency, indicated that seven million Zaires were budgeted for agriculture.

In 1973 the Office of the Presidency directly controlled 30.2 percent of total government payment authorizations and 40.2 percent of total government payments for development projects. Some of these projects are agricultural development schemes or schemes which directly benefit agriculture. Thus, the real government expenditures for agriculture are higher than those shown in Tables 2.8, 2.9 and 2.10. Nevertheless,

[8]The regional Department of Agriculture administration is funded in part through the regional budget.

Table 2.9. Republic of Zaire: Government Expenditures in Agriculture, 1968-1973 (In Thousand Zaires[1])

Type of Expenditure			1968	1969	1970	1971	1972	1973
Current Expenditures	Anticipated Expenditures	Agriculture	2,291	2,531	3,313	1,641	5,423	7,277
		Total Budget	112,771	145,000	163,455	218,000	257,366	262,892
		Percentage for Agriculture	2.0	1.75	2.03	0.75	2.11	2.77
	Effective Expenditures	Agriculture	546	1,836	1,516	2,469	6,699	. . . .
		Total Budget	169,613	212,631	264,572	279,378	278,796	. . . .
		Percentage for Agriculture	0.32	0.86	0.57	0.88	2.40	. . . .
Investment Expenditures	Anticipated Expenditures	Payment Authorizations for Agriculture	4,900	4,726	4,067	177	1,935	1,649
		Total Authorizations	49,094	78,750	110,980	116,267	68,799	174,608
		Percentage for Agriculture	10.0	6.00	3.66	0.15	2.81	0.94
		Payment Credit for Agriculture	3,200	2,614	2,219	2,075	3,540	2,042
		Total Credit	18,179	40,000	51,500	66,899	72,635	83,196
		Percentage for Agriculture	17.90	6.54	4.31	3.10	4.87	2.45
	Effective Expenditures	Agriculture	1,801	3,408	2,134	2,032	813[2]	. . . .
		Total Expenditures	25,616	52,501	62,379	68,265	37,583	. . . .
		Percentage for Agriculture	7.03	6.49	3.42	2.98	2.16	. . . .

[1]Nasse, et al., 1973, p. 8 and République du Zaire, Novembre 1973. Conjoncture Economique, Année 1972 et Ier Trimestre 1973. Kinshasa: Ministère de l'Economie Nationale, Nr. 13, 111-114.

[2]First Semester of 1972.

Table 2.10. Republic of Zaire: Anticipated Total Government Expenditures in Agriculture (Current and Payment Credit for Investment), 1968-1973 (In Thousand Zaires[1])

Government Expenditures	1968	1969	1970	1971	1972	1973
Agricultural Sector	5,491	5,145	5,532	3,716	8,963	9,319
Total Expenditures	130,950	185,000	214,955	284,899	330,001	346,088
Percentage of Agriculture in the Total Expenditures	4.2	2.8	2.6	1.3	2.7	2.7

[1]Table 2.9 and compilations by the author.

government expenditures for agriculture are low, and a rather drastic shift in budget priorities is needed if agriculture is to become the priority of the priorities. Recently, for instance, an agricultural development bank has been created (SOFIDAG: Société Financiére de Développement Agricole), an institution which could play a vital role in channelling more funds into agriculture.

The current expenditures on agriculture increased from 2.03 percent in 1970 to 2.7 percent of the total government budget in 1973 as shown in Table 2.9. However, the Department of Agriculture can not fully utilize its current and investment allocation because of a shortage of qualified staff to execute programs.

The investment budget is aimed at the achievement of long-term development goals and is divided in two cateogries: payment authorizations which reflect multi-year commitments and payment credits which are the annual disbursement of investment funds. Payment authorizations for agriculture have been declining since 1968 in absolute and in relative terms. Moreover effective investments have been declining in relative terms over the same period and in absolute terms since 1969.

It is clear that agriculture holds a low priority in government policies. Indeed, agriculture occupies a low status position of all Zairean society. However, the picture is beginning to change somewhat. Current anticipated and effective government expenditures for agriculture have been increasing absolutely and relatively since 1971 and a further increase is expected.

Pricing Policies, Wages and Taxation

The Department of National Economy is responsible for price and wage policies. In October 1967, with the currency reform, new price and wage regulations took effect.

The present agricultural pricing policy is characterized by minimum producer prices for almost all food and export products, maximum wholesale food prices, fixed producer prices for crops sold to government marketing agencies and fixed marketing and profit margins for the wholesale and retail levels.[9] Thus, three different price regulations are established:

1. Minimum producer prices are fixed for all export crops and for maize, rice, manioc and groundnuts. Regional authorities are permitted to establish minimum producer prices for maize, manioc and groundnuts for other products, regional authorities can fix prices at levels not exceeding ten times actual prices in June 1960.

2. Fixed producer prices: for seed cotton and coffee; a uniform price is fixed for all regions.

3. Maximum wholesale prices: for rice, maize, wheat, flour, palm oil, sugar and cattle.

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[9] The author published an article on the effect of these price regulations on domestic production and imports in the maize subsector [Tollens and Kamuanga, 1975].

Minimum producer prices and maximum wholesale prices remained largely unchanged until 1972 in spite of a rise of 44 percent in the retail food price index for Kinshasa from December 1967 to February 1972.[10] With the creation of several government commodity marketing offices in 1973-74, however, most prices were adjusted upwards. The price of seed cotton was raised in 1970, 1971 and 1974 and the price of coffee was increased in 1972 and 1974. In 1969, maximum wholesale and retail margins were established for imported products.

It is generally believed that the farm gate prices tend to stabilize near the fixed minimum price level set by the government because of the oligopsonistic or monopsonistic power of traders and middlemen. Regulations concerning maximum prices and margins have generally not been respected. Indeed, such legislation is difficult to enforce.

The government fixes minimum wages for workers according to skill and region. Commercial (plantation) agriculture is practically the sole employer of salaried labor in agriculture, and across the board salary increases of 30 percent were decreed in 1971. In addition, Zaire's social security system, probably the oldest and most advanced system in Africa [Wembi, 1966], has the general effect on employers of doubling wage costs as a result of increases in social security contributions and fringe benefits such as housing, medical care, transportation, schooling.

Taxes are administered by the Department of Finance. A net profit tax of 40 percent applies to all agricultural firms and corporations,

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[10] There are a number of different price indexes in Zaire. This information is derived from the "Retail Price Index of Current Consumption Goods in Kinshasa Markets" published by I.R.E.S., Kinshasa.

while the personal minimum tax (C.P.M.: contribution personnelle minimum or minimum personal contribution) is fixed at 2 Zaires per year for all able-bodied adult males who do not have a paid job. Employed males pay an income tax on the basis of their wage.

Excise taxes are levied on beer, wines, alcoholic beverages, tobacco and sugar. These taxes generate the largest revenue of all agricultural taxes. Taxes on agricultural exports are second in generating revenue from agricultural products. Several types of these taxes are levied:

1. export duties: are ad valorem taxes levied on the basis of the F.O.B. value at the principal port of export, Matadi. Rates differ depending on the product and, for some products such as palm oil, on the export price.
2. turnover tax (T.C.A.: taxe sur le chiffre d'affaires): is similar to a sales tax and also applies to exports. The rate is 6.75 percent of agricultural export proceeds.
3. statistical tax: ad valorem rate of 1 percent and applies to all exports to cover the cost of collecting trade statistics.
4. research tax (taxe de sélection): a tax designed to foster agricultural research. This tax is levied on all agricultural products except forest products. The rate is 2 percent of the F.O.B. value with the exception of cotton to which a 1 percent rates applies.

For most agricultural products, total export taxes are between 10 and 20 percent of the export value, depending on the year (as export levies change from year to year).

Imported inputs for agriculture are also subject to taxes: custom taxes, fiscal taxes, turnover tax and statistical tax. Up to 1973, the effective rate of fertilizers, insecticides and farm machinery was about 22 percent. Since January 5, 1973, import taxes (custom taxes) for vital foodstuffs (beef, maize, rice, wheat flour) and for agricultural inputs (fertilizers and insecticides) have been abolished while luxury products have been taxed more accordingly.

Agricultural Development Projects and External Aid

In this section only the major projects related directly to agricultural development will be discussed. A major agricultural development scheme for cotton and food crops is underway at Gandajika in Eastern Kasai. This project, considered as one of the most successful in Zaire, is financed by the European Development Fund (FED). Other FED projects are a tobacco project in Shaba (formerly Katanga), an oil palm and cocoa scheme in Ubangi and a tea development project in Northern Kivu.

USAID is committed to bringing the "Green Revolution" to Zaire. They operate a maize breeding, seed distribution and fertilizer application project in Shaba. A pilot agricultural credit project in lower Zaire region financed by USAID was terminated in 1972. In addition, about twenty Zairean crop scientists are being trained at CIMMYT in Mexico.

A large mechanized maize production project at Kasese in the Kaniama area is now in its third year. A large cattle ranch is associated with this project. The project is supported by Belgian technical assistance and is aimed at an annual production of 50,000 tons of maize on 18,000 hectares and a cattle ranch of 13,000 head by 1980. In the

North of Ubangi a Belgian team operates a general rural development project with agricultural extension, tractor mechanization and a distribution of small farm implements and improved seeds to farmers. Belgian technical assistance personnel are also working in the Faculty of Agronomy at Yangambi and in the Higher Institutes of Agricultural Education at Bengamisa and Mondongo.

INERA receives substantial Belgian assistance for its administrative and research work, while the Federal Republic of Germany is aiding INERA in developing livestock research and extension in the Ituri region. The World Bank is developing three livestock ranches in Shaba, with a project goal of 79,000 head of cattle. The World Bank also has a major stake in road maintenance programs which receive additional financial support from FED, USAID and the other bilateral donors.

Rice production and extension schemes in several parts of the country are supported by the Mainland China Agricultural Mission, and the French technical assistance program has a vegetable production project near Kinshasa and a fisheries project at Lake Mai Ndombe. Moreover, the Canadian government is sponsoring a major forestry project, including a detailed inventory of part of the central basin equatorial rain forest and the training of Zaireans in forestry at the University, the Department of Agriculture and in a Higher Institute of Agricultural Education.

Finally, the Department of Agriculture receives technical assistance from several agencies: a Belgian team operates in several divisions; a French team from BDPA is engaged in economic research and planning; a USAID team is setting up an Agricultural Economics Research Center; and UNDP/FAO experts provide assistance in the statistical division and in other offices.

Agricultural Marketing and Transportation

Zaire is almost entirely within the drainage system of the Zaire River. The transport network is built around the Zaire River and its affluents with 1,700 miles of navigable waterways. The whole Zaire basin river system totals about 7,200 miles of such waterways. Railroads bypass unnavigable portions of the rivers or feed into the river ports. There are 3,125 miles of rail lines, and roads act as feeder lines for both rail and river transport.

The transport system is geared to the export port of Matadi via a rail connection with Kinshasa and to the port of Lobito in Angola via a rail connection with Dilolo. Connections between regions, especially in The North-South direction, are poorly developed making interregional exchanges difficult.

The government operates the National Transport Office (ONATRA) which assures traffic on the waterways, the exploitation of the ports and the Kinshasa-Matadi, Tshela-Boma and Kisangani-Ubundi railroad. The second public transport institution is the Zaire Office for the Railroads of the Great Lakes (C.F.L.) which connects Kindu to Kalemie and Kabalo to Kabongo by railroad, assures transport on the Kivu Lake and operates the ports of Kalundu, Bukavu and Goma. Air Zaire, which recently acquired an impressive fleet of modern jet planes, is also a government company.

Road repair and maintenance on the major roads is carried out by a government agency, the Office des Routes, which receives substantial aid from the World Bank and USAID. Feeder roads are to be maintained by the local communities alongside the roads.

The government intervenes in agricultural marketing via parastatal organizations. These organizations operate under the authority of the

Department of Agriculture and depend on the government for financing. Prior to November 30, 1973, there were five parastatal organizations concerned with agricultural marketing:

1. the Office of Robusta Coffee (OCR),
2. the National Coffee Council (CNC),
3. the National Textile Fibers Office (ONAFITEX),
4. the Office for Agricultural Products of the Kivu (OPAK),
5. the Office for Agricultural products and Ranching of Kisangani (OPAEKI).

ONAFITEX was created in 1971 to replace COGERCO and COVENCO, which dealt with cotton ginning and selling. In July 1972 OCR and CNC were merged in a new institution, the National Coffee Office (ONC), modeled after ONAFITEX, while in 1973 the National Livestock Development Office (ONDE) was established primarily to coordinate the management of government ranches. In the same year a National Ivory Office (ONI) was instituted with monopoly power for buying and selling of ivory in order to reduce illegal exports.

On November 30, 1973 President Mobutu Sese Seko announced a government take-over of all plantations, ranches, farms and agro-industrial complexes held by foreigners for distribution to Zairean nationals and to the government. The main purpose of this move was to place the agricultural economy under the direct control of the Zairean people. In implementing this order, seven new parastatal marketing offices were created. They are:

1. the National Forest Office (ONB),
2. the National Cocoa Office (ONC),

3. the National Fisheries Office (ONP),

4. the National Sugar Office (ONDS),

5. the National Natural Rubber Office (ONCN),

6. the National Oleaginous Office (ONO),

7. the National Cereals Office (ONACER).

This list brings the total number of government marketing offices controlled by the Department of Agriculture to ten.[11] These product marketing offices include export crops as well as crops or foodstuffs for domestic consumption. They are basically one-channel marketing institutions with a buying and selling monopoly. However, their activities are not restricted to buying, selling and exportation. They also manage directly plantations, ranches, farms and processing plants. Thus, they have an important stake in production, transportation, processing, storage and export of agricultural products. The government is now directly responsible for several of the most important agricultural production and marketing activities.

The newly created structures and institutions are still very young and subject to drastic changes, overhaul or simple abolishment. Several of the new offices were recently abolished or merged with other offices and the situation is not clear as to what offices are now effectively operating. Certainly, a bold step has been taken by the government in the field of agricultural production and marketing, but only time will tell if the newly created vertical structures under direct government control will be able to foster increased production, incomes and employment for the millions of small traditional Zairean farmers.

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[11]The National Ivory Office is not included in this list because it is part of the Customs Service.

Major Problems Facing the Agricultural Sector

The Zaire government now places priority on agricultural development, although this has not yet been clearly translated into budget allocations. Moreover, large rural to urban migration seems to continue unabated, and most cities will double their population every fifteen years or less if present urbanization trends continue. Still, the demand for foodstuffs through commercial channels is strong, and this demand has been met by increasing imports. This leads to the major problem now facing the agricultural sector in Zaire: providing more food for urban areas.

Achieving Self-Sufficiency in Basic Food Products

Imports of maize, rice, sugar, meat and fish have been increasing rapidly, yet there is no technical reason why this demand cannot be met from domestic sources. The country has been self-sufficient in these products in the past, and with a larger share of foreign exchange reserves now being spent on oil and energy-intensive imports, there is an urgent need to decrease food imports.

Sugar is grown on large industrial plantations and new production units are now being planned although smallholder production of sugar cane is presently not considered as feasible. Still consumption of sugar is increasing rapidly, at a rate of about 10 percent per year.

Cattle are kept on large ranches in the North and South of the country. There is also smallholder livestock production in the Ituri and in the Kivu region. Tsetse fly infestation limits cattle production in many forested areas. Several projects are underway to increase beef production with the aid of the World Bank, the Federal Republic of Germany, USAID and Belgium. The major effort is focused on increasing the number of cattle on government ranches and on providing veterinary services to smallholders in the North-East. By 1980, Zaire could be self-sufficient in beef.

Poultry accounts for 12 percent of total meat production and 25 percent of meat consumption. Indeed, rapidly increasing consumption has been met by increasing imports (in 1972 Zaire imported 2,746 tons of poultry meat). But poultry production in large production units could be developed rapidly as an important source of meat for the cities, the only major constraints being the availability of concentrated feedstuffs and disease control.

For sugar, beef and poultry, then, prospects for meeting domestic demand by 1980 are relatively good because of the commercial, capital intensive nature of these products which call for direct government intervention in production and marketing. Such is not the case with other food products.

Fish is the most important animal protein source, yet only about half of the fish catch passes through commercial channels. The major method of augmenting fish production is by increasing fishing on lakes. In fact, pisciculture was well developed before independence, but disappeared almost completely afterwards. A French technical assistance team is currently surveying fishing potentials in Lake Mai Ndombe. But although such potentials for increasing fish production are good, little effort is being directed toward realizing them.

Maize and rice offer the greatest potential for rural employment creation. Both cereals are grown solely on traditional farms,[12] with maize being grown primarily in the South and rice in the North. Internal demand for both commodities is strong and is increasing. In fact, the Department of National Economy estimates that maize consumption will increase at an annual rate of 6 percent. Rice production, according to FAO estimates, needs to double between 1970 and 1980 to cover domestic consumption.

Major constraints to the development of maize and rice production needed to meet these demands are to be found in declines of yields, lack of production incentives and marketing problems. It is the lack of fertilizer use combined with the planting of traditional varieties which explain, in part, the low yields obtained for both maize and rice. Substantial progress could be made by the use of modern inputs. This, however, will require a renovation of the agricultural extension service which has not been retrained since 1960 and which lacks a means of transportation.

Expansion of Smallholder Export Crop Production

Smallholder export crops with the greatest potential for expanding production are coffee, cotton and cocoa, with coffee ranking now as the first agricultural export crop in Zaire followed by palm oil. Coffee production and exports have increased substantially since 1968, mainly because of an increase in smallholder production. Grown on commerical plantations and on traditional farms, coffee is also the most important

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[12] A notable exception is the large mechanized maize scheme in the Kasese-Kaniama area of Eastern Kasai.

export crop of the traditional sector. In fact, coffee exports, primarily Robusta, surpass slightly the export quota assigned by the International Coffee Organization. Coffee diversification has been called for by the government although coffee is without a doubt the most profitable cash crop of traditional farmers, and although the technical conditions for growing coffee in Zaire are excellent. But with the present uncertainties about the continuation of the International Coffee Agreement, it is doubtful whether Zaire should undertake efforts to diversify away from coffee and promote other, less profitable cash crops.

Cotton is exclusively produced by smallholder peasants. It is grown in rotation with food crops, and its production is widely dispersed in the North, South and East of the country. Zaire cotton fiber is of high quality because of hand picking, and demand prospects, for the domestic market and for export, are bright.

Cotton and coffee are the typical cash crops introduced during colonial times in paysannats which were created from 1945 onwards on a large scale in an effort to rationalize traditional agriculture. After 1960, however, paysannats collapsed as the discipline required for such a settlement scheme broke down with the upheavals of independence. The government now wants to revive some of these paysannats.

Cocoa has never been grown by smallholders in Zaire in contrast with West-Africa. Still, the ecological conditions for cocoa production in certain areas of Zaire are favorable and export opportunities are good. However, this crop has never received the attention it merits. Cocoa does require relatively more farm processing than coffee, and this may constrain the introduction of cocoa in traditional farming. But the West African experience teaches us that this problem can be overcome. The planting material presently used in Zaire produces yields inferior to those in West Africa, but high yielding strains are available from INERA. Thus, the introduction of cocoa in smallholder production could provide opportunities for crop diversification and employment creation.

The Transportation System

Rural areas in Zaire are sparsely settled with some exceptions.[13] In fact, only about 1.2 percent of all land is occupied. Villages are widely dispersed over much of Zaire, and the dispersed pattern of village settlement makes it extremely costly to connect villages with urban areas.

Major attention is now being devoted by the "Office des Routes" to the major roads and to the bridges and ferries, though while the major road connections are being rehabilitated, the feeder roads remain a major bottleneck. And it is the feeder roads which are important in providing an outlet for agricultural commodities and in bringing improved inputs and consumer goods into rural areas. Ferries and bridges on these roads are often deficient. Feeder roads deteriorate very rapidly due to erosion by rains. The continual poor condition of the roads results in high transportation costs due to breakdown of trucks, accidents, lack of spare parts, etc. In the northern cotton belt, for example, according to ONAFITEX management, it presently takes three times

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[13]High population densities are found in parts of Lower Zaire, Kwilu, Eastern Kasai, Northern Kivu, Lower Uélé (Isiro) and Ubangi (Gemena).

the number of trucks than necessary with well maintained roads to haul seed cotton from farmers in a comparable time span. Thus, for some time, poor transportation is likely to remain one of the principal obstacles to agricultural development.

Improving the Performance of the Marketing System

The urban population in Zaire is increasing rapidly, straining the urban food marketing systems. Kinshasa, with a population of over 1.3 million, typifies the problems of the other cities. Marketing margins are high and an increasing reliance is put on food imports. A proliferation of handlers and middlemen operating at the wholesale and retail level and high transportation costs result in a wide spread between prices paid by consumers and prices received by producers. In addition, losses in handling and in storage are quite high due to spoilage, and insect and rodent damage. Price signals at the retail level are buffered by the large margins and, thus, inadequately transmitted to the producers. On the other hand, only a limited range of consumer goods is offered to the farmers, and because of high transportation costs and a small number of suppliers, these consumer goods are relatively expensive. Most plantations have their own retail stores for such goods.

The government is aware of the inefficiencies in the urban food marketing systems and has intervened with the announcement of maximum or fixed retail prices, the building of modern market facilities and the opening of government operated retail stores ("the Economat du Peuple").

The recent creation of government marketing offices for most of the agricultural products entering commercial channels is designed to coordinate marketing activities by centralization, to increase efficiency of the marketing system and to put control of commercial agriculture in the hands of Zaireans. These offices offer unique opportunities for vertical coordination and economic integration of the country. For products which are mainly consumed locally (rice, maize, sugar, meat), the offices should be able to provide consumers with better quality produce at lower prices.

A major constraint on improving agricultural marketing performance is the lack of adequate data and detailed studies on pricing, marketing margins and demand. This is related to the shortage of qualified staff at the Department of Agriculture and the general lack of concern with agricultural development. However, since agricultural development became a top priority, several actions have been taken to strengthen the institutions serving agriculture and to generate data on the agricultural economy.

Summary

The agricultural potential of Zaire appears to be enormous. The natural endowment generally favors agricultural production, with soils of average fertility for tropical land, plentiful rainfall and extended dry seasons only in the North and South. Seasons alternate between the North and the South as the country is astride the Equator, and forests cover 45 percent of the country, containing a tremendous potential output of timber.

However, only 1.2 percent of the land is cultivated and agriculture contributes only 18 percent to GDP. Several major foodstuffs--rice and maize--which technically can be grown in the country are imported.

Seventy percent of the population are rural. Agriculture has a low value in Zairean society. The predominant share of field work is done by women. Also, emphasis on agricultural development has been weak as government revenues and foreign exchange are mainly derived from the export of minerals. Then, too, the Department of Agriculture has a shortage of qualified staff and is not able to utilize fully the budget earmarked for its operations. Moreover, yields for several crops have been decreasing because of degeneration of seeds, disease attacks and poor crop maintenance, and the agricultural extension service is largely ineffective because of lack of training and lack of means of transportation.

Another constraint is that agricultural production is widely dispersed over the country. The transportation system is deficient and constitutes a major impediment to the expansion of agricultural production. The high marketing margins have an adverse effect on agricultural production. High taxes on exports of agricultural products and taxes on imports of improved inputs also have a negative effect on agricultural output, though recently, product marketing offices have been created to solve this and other major problems in agricultural production and marketing.

CHAPTER III

COTTON PRODUCTION IN NORTHERN ZAIRE

History of Cotton Production in Zaire

Introduction of Cotton[1]

The first European explorers found cotton growing wild in Zaire. Undoubtedly, it was introduced by slave traders from Egypt and Sudan and by Portugese traders from Angola. From 1890 on, missionaries and settlers tried to introduce cotton without success. In 1908 experiments were undertaken in Bas-Zaire (Kitobola) by a government agronomist, J. Claessens who concluded that the area was not suitable for cotton production.

In 1913 the Director General of Agriculture in the Ministry of Colonies, Edmond Leplae, charged Mr. Edward Fisher, an American cotton specialist, with the systematic undertaking of cotton growing experiments in Zaire. From 1915 to 1920 he introduced the American variety, Triumph Big Boll, in the Sankuru-Kasai and in Maniéma (Kivu) and obtained satisfactory yields in regions with moderate altitude and a pronounced dry season.[2] As a result, the colonial government decided to extend the production of cotton to other regions. In 1918 cotton growing became compulsory in all provinces except Leopoldville under a 1917 decree

[1]This section is based on Banneux [1938] and Brixhe [1958].

[2]Cotton cultivated in Zaire is of the species Gossypium Hirsutum.

on compulsory crops (cultures obligatoires-cultures éducatives). The long term aim of this law was to stabilize the rural population, improve their nutrition, educate them and increase their incomes [Leplae, 1933]. Cotton was considered a rich product; it was easily transported and stored and it would rapidly generate income for farmers. It would also supply the well developed Belgian textile industry.[3]

When cotton was first introduced, the government bought the crop. In 1918 the colonial government ordered two ginning mills from the USA. On February 10, 1920 COTONCO, the first important private cotton company, was set up to develop the cotton industry in Zaire.

For the East and South where the mining industry was developing rapidly, the government introduced limits to the expansion of cotton production in order to save labor for the mining activities and to avoid food shortages for mine workers. However, it was discovered that the cotton growing regions became the main food producing areas as cotton was well adapted to a food crop/cotton rotation, especially manioc, maize, groundnuts, rice, beans and bananas. As a result, cotton production was extended to the mining regions.

Growth of Cotton Production

The growth of cotton production is presented in Table 3.1. Between 1915 and 1930 seed cotton production increased rapidly from one ton in 1915 to over 30,000 tons in 1930. Over the next decade production more

[3] Cotton was introduced in the Central African Republic in 1924 by Félix Eboué. This crop was also compulsory until 1954. However, it has remained as an imposed crop in the eyes of farmers. [De Dampierre, 1960]. Commercial cotton production was introduced to Nigeria in 1902 by the British Cotton Growing Association [Kriesel, 1968].

Table 3.1. Republic of Zaire: Seed Cotton Production, 1915-1974 (In Tons)

Year	Source of Data	Seed Cotton Production	Year	Source of Data	Seed Cotton Production
1915	1	1	1946	2	117,852
1916	1	12	1947	2	116,353
1917	1	106	1948	2	123,904
1918	1	320	1949	2	143,081
1919	1	450	1950	2	138,389
1920	2	1,527	1951	2	133,402
1921	2	1,770	1952	2	158,347
1922	2	3,105	1953	2	136,411
1923	2	2,610	1954	3	143,348
1924	2	5,130	1955	3	145,726
1925	2	9,167	1956	5	154,481
1926	2	14,928	1957	5	129,829
1927	2	17,639	1958	4	142,507
1928	2	20,207	1959	6	179,660
1929	2	21,754	1960	6	140,077
1930	2	30,600	1961	6	64,630
1931	2	44,799	1962	6	38,873
1932	2	26,775	1963	6	42,820
1933	2	46,400	1964	6	40,210
1934	2	59,160	1965	6	18,700
1935	2	77,781	1966	6	19,960
1936	2	92,105	1967	6	24,910
1937	2	106,496	1968	6	45,210
1938	2	122,468	1969	7	47,400
1939	2	112,228	1970	7	53,800
1940	2	132,104	1971	7	59,500
1941	2	138,024	1972	7	52,980
1942	2	117,836	1973	7	66,915
1943	2	128,796	1974	7	64,840*
1944	2	90,559			
1945	2	111,253			

Source of Data:

1 [Ministère du Congo Belge et du Ruanda-Urundi, 1960].
2 [Brixhe, 1958] and [INEAC, August 1954].
3 [Van den Abeele and Vandenput, 1956].
4 [IRES, 1968].
5 [Ministère des Colonies, 1957].
6 [Ministère de l'Agriculture et du Développement Rural, 1970].
7 [ONAFITEX, personal communication].

*estimation

than quadrupled and reached 132,104 tons in 1940. However, production fell drastically in 1932 in response to falling world prices. Prices paid to the farmers in 1932 (0.60 franc/kg) were only half of the 1931 level.

The government abandoned cotton production in the northern areas because of the large distances separating these areas from the main transportation routes. Cotton farmers protested in these regions and again received cottonseed the next year. The development of an effective agricultural extension service by the government and by the private cotton companies was largely responsible for the rapid increase in production.

During World War II production dropped considerably as cotton farmers were directed to tap natural rubber from liana's in forests and to work in "crash" rubber plantations. Cotton production in the Lake Mai Ndombe area was abandoned and the cotton extension effort slowed down. After the war production recovered slowly at first and then increased steadily to a peak of 179,660 tons in 1959. During the first years of independence, production tumbled and reached a low point of 18,700 tons in 1965, about one-tenth of the 1959 level. With improved security under the Mobutu regime, production gradually recovered and has remained at 60,000-65,000 tons since 1971.

Ecological Conditions Governing Cotton Production

According to Sinclair [1968], a minimum rainfall of 500 mm. per year is required to provide adequate soil moisture for cotton production. For optimum growth, an average growing season temperature of just over 21° C. is also required as well as adequate sunshine. Brixhe [1958] states that cotton is only sensitive to extreme temperatures below 5° C. or above 38-40° C. Thus, if we look at temperatures only, most of Zaire would be suitable for cotton production. However, the distribution of rainfall encourages production immediately to the North and to the South of the equatorial rain forest. Cotton requires a dry season about five months after planting for the maturing of cotton bolls. Hence, the central basin and the high plains in the East which have a regular rainfall are unsuitable for cotton, while in the northern or southern savannahs or bush savannahs, there is a marked dry season for several months which is ideal for the maturation of cotton. Between 400 and 800 mm. of rainfall is recorded in these areas in the five months preceding the dry season, an amount which is needed for the vegetative development of the cotton plants. The northern and southern borders of the equatorial rain forest have a dry season of one to three months which is sufficient although not ideal for the cotton harvest.

In the northern zone cotton matures by the end of the year, while in the southern zone cotton is picked in June-August. Hence, there are two cotton harvests a year in Zaire and a fairly even flow of fiber to the textile mills.

Soils play a crucial role in determining yields. Generally, the soils in Zaire have a very low retention capacity. The clay fraction is predominantly kaolinite which is characterized by a low retention power. Thus, water and nutrient retention in the soils is poor. Much of the soil fertility depends on humus content, which is rapidly broken down because of the low retention power of the soil, the high temperatures and the 1200 to 1800 mm. of annual rainfall which leaches the soils thoroughly.

This explains why soils are very rapidly depleted, on the average after two to three years of cultivation, and need long fallow periods to regain their fertility, normally a period of ten to twenty years.

Principal Cotton Production Regions

There are two major cotton production regions: the northern and the southern belt. The production seasons alternate between these regions as they are located on each side of the Equator.

Van de Walle [1960] distinguished three cotton regions in Zaire according to a productivity criterion and the possibilities for crop intensification: a high yielding region A, a marginal region B and an uneconomical region C. In region A farmers produce a minimum of 2,000 tons of seed cotton per zone with an average yield per hectare exceeding 375 kg.; in region B the minima are 1,000 tons and 300 kg./ha. and in region C, less than 1,000 tons and less than 300 kg./ha.

COGERCO estimated in 1958-1959 that 874,698 families grew cotton: 561,943 in region A, 72,324 in region B and 240,421 in region C. After independence, the number of cotton farmers dropped and is now roughly estimated by ONAFITEX at 500,000. If we accept that region A farmers continue producing cotton and that region B and C farmers dropped out, which corresponds roughly to the present situation, then we arrive at the figure advanced by ONAFITEX. In 1958-1959 the number of region A cotton farmers in Ubangi, Mongala, Bas-Uélé and Haut-Uélé was equal to 246,285.

De Plaen [1957] defined five distinct cotton production regions in Haut-Zaire region based on average first year seed cotton yields. These regions have distinct soil characteristics in terms of soil color, texture, acidity, exchangeable bases and organic matter. In Region I, average yields exceeded 800 kg. per ha. This is the central cotton producing region in Haut-Zaire, including the following urban centers: Buta, Titule, Bambesa, Dingila, Poko, Rungu, Isiro and Wamba. Soils in this region contain over 40 percent of clay, have a high percentage of exchangeable bases and a pH of 6.0. Region II includes the northern savannah's with yields from 400 to 600 kg. per ha. Region III is to the North-West of Region I, mainly a forest area, with yields similar to Region II but with distinct soil characteristics. Region IV is to the South-West of Region I. Yields were quite variable but the number of observations was small. Region V is located East of Region IV and to the South of Region I. Yields exceeded 1000 kg. per ha. but again the number of observations was limited.

The regional administrative organization of ONAFITEX is as follows:

General Headquarters: Kinshasa

1. North-West Regional Branch for Equator region; sub-regions Ubangi and Mongala; seat: Gemena.
2. North-East Regional Branch for Haut-Zaire region; sub-regions Bas-Uélé, Haut-Uélé and the zone of Mahagi in Ituri.
3. Central Regional Branch; sub-regions Maniéma and the zone of Shabunda in South-Kivu; seat: Kasongo. The sub-region of Sankuru and the zone of Uvira are also located in this area but are responsible to the general headquarters in Kinshasa.
4. Southern Regional Branch; the regions of Shaba, Eastern and Western Kasai; seat: Gandajika.
5. Zone Uvira; zone of Uvira, Fizi and Walungu; seat: Uvira.

6. Zone Sankuru; sub-region of Sankuru; seat: Kutusongo.

Each regional branch reports directly to the general headquarters in Kinshasa. However, the regional branches have substantial latitude in the management of their operations. Each regional branch corresponds more or less to a homogeneous cotton growing area.

It should also be noted that there are two special areas producing long staple cotton in the eastern part of Zaire: the Mahagi area and the Ruzizi Valley. Their cotton crop is exported via Dar es Salaam. In the Mahagi area near Lake Mobutu Sese Seko (formerly Lake Albert), cotton was introduced in 1938 from Uganda. The first variety was S47 characterized by long staples (1 1/8 inch). Present varieties are of the Satu type, also from Uganda. This area produces about 1,000 tons of seed cotton which is ginned at the mill in Mahagi, the only ginnery in Zaire equipped with roll gins instead of saw gins. The Ruzizi valley is located along the Ruzizi River on the Burundi frontier, connecting Lake Kivu with Lake Tanganyika. The soils in this valley are very fertile, probably the richest soils in Zaire, but the area is insalubrious. Cotton yields are the highest in the country and the fiber is of very high quality; the staple length is 1 3/32 inches.

Human Factors in Cotton Production

Cotton, in many ways, is a unique crop. Unlike most of the other export crops, it is an annual crop grown exclusively by smallholder Zairean farmers. Cotton also is one of the most regulated crops, with cotton legislation dating back to 1917. Cotton was the main crop grown in the paysannats. The farmer gets free seed every year from the ginneries. Thus, it is easy to introduce improved seeds. The most unique feature, however, is that cotton production was made compulsory by the government in 1918 because it was assumed that farmers would find cotton to be profitable and, as a result, they would expand production on their own initiative and the government could then drop the compulsory requirement. However, the colonial government retained the requirement until it was abolished in 1958. As shall be pointed out later, this research has shown that regional governments still utilize the imposition technique today.

Historically, before the advent of the colonizers, Zaireans were the victims of inter-tribal wars, slave razzias and frequent migration. Their settlements were always temporary. These nomadic features are largely responsible for the poor knowledge of agriculture. Their warrior-like behavior made them predominantly hunters and fishermen, leaving the cultivation of the land to their wives. Today the bulk of the labor for agricultural production, processing and marketing of agricultural products is done by women, while the men clear land, build houses and hunt and fish. Moreover, rural people have marked urban aspirations. These aspirations, both existential and material, are unconditional and urgent [Fox, 1970]. Agriculture, in the sense of "working the land," occupies a very low status. It was never a positive value.[4]

According to Fox, kinsmen and tribesmen are the fundamental sources of security, power, prestige, prosperity, fecundity and physical

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[4]The Faculty of Agronomy in the National University of Zaire has great difficulty in recruiting students. Also, the Department of Agriculture has a very low budget and has great difficulty in recruiting and retaining staff.

and psychic well-being. High levels of distrust, suspicion and anxiety characterize personal as well as impersonal relations. Beliefs and customs require the individual who does well financially to support relatives who are less fortunate. Fox hypothesizes that the tribal structure, kinship and the extended family system act as a severe constraint on producing much above subsistence.

The colonial approach attempted to overcome these cultural factors by imposing compulsory production requirements. The colonizers believed that obligatory cultivation of certain crops was a necessary part of the "educational" process.

In Zaire it was introduced by the decree of December 5, 1933; it required 60 days per year (45 after 1955) of compulsory cultivation or other public works for each able-bodied adult male (H.A.V.)[5] This law was generally applied until 1957 and was still legally authorized although largely abandoned in 1960 [Young, 1965].[6]

A number of stern measures were used to maintain the obligatory system. For example, the 1947 Senate commission reported that about 10 percent of the adult male population had spent some time in prison, in good part because of violation of the agricultural requirements. Thus, to the rural population, cotton was an extremely unpopular crop; many

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[5]Each able-bodied adult male was also subject to the personal minimum tax (C.P.M.) which tied tax collection to cotton growing. Usually, the C.P.M. tax is collected on the same day and at the same location as the purchase of seed cotton from farmers.

[6]The imposed surface per H.A.V. varied between 15 and 50 ares with a mean of 30 ares.

peasants considered it simply a tribute levied by the European ruler[7] [Young, 1965].

Imposed cultivation on food crops started during World War I when troops were sent to eastern Zaire to guard against a possible attack from the German Colonies. Since more than 260,000 soldiers had to be fed the government required each farmer to grow certain food crops. This operation was quite successful and, encouraged by this experience, the government extended required cultivation when the war was over to the rural hinterland adjacent to urban centers and mining camps in order to supply the African population with staples. When cotton began to be emphasized, it became a required crop in many areas of Zaire [Leplae, 1933].

This system required a vast administrative organization of the countryside; there was at least one agricultural officer per zone, supported by several African agricultural assistants and monitors.[8] Also there were the cotton extension agents supported by the private cotton companies. Thus, in the perception of Zaireans, it was the "government" which made them grow cotton for the benefit of the cotton companies. The sharp fall in cotton production after 1960 can be partially attributed to the unpopularity of the crop and the constraint

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[7]Young [1965] noted that many of the low cotton yield areas, such as North-Shaba, Maniéma, much of Sankuru and parts of Haut-Zaire coincided with the zones of radical nationalist response during the rebellion years.

[8]On the average, there was one European extension agent for every 2,000 to 3,000 cotton farmers [Brixhe, 1958]. In 1959, there were more than 6,000 agricultural extension workers in Zaire, of whom over 1,200 held diplomas; they were supervised by 200 Congolese agricultural assistants and 418 Belgian specialists [Jurion and Henry, 1969].

used to enforce its cultivation. The question now is whether fifteen years after independence, obligatory cultivation is still in effect and enforced. The answer is yes, as will be documented in Chapter VI.

Cotton Research

Cotton farmers in Zaire do not utilize any cotton for domestic purposes. Farmers sell nearly 100 percent of their harvest. Fraud is nearly impossible as ONAFITEX has a monopoly on the purchase of seed cotton. Each year, the farmer sells his cotton to the ginnery which then issues the next season's seeds. Thus, new seeds can be introduced easily via the ONAFITEX ginneries in one or two years.

In 1933 the National Institute for Agricultural Studies of the Congo (INEAC) was created as a quasi-governmental independent organization,[9] replacing the former Department of Plantations.[10] In 1959 INEAC operated seventeen research stations, fourteen experimental centers, five experimental plantations and a veterinary laboratory. INEAC has made a number of major contributions to Zairean agriculture, especially in increasing productivity on perennial plantations, in launching paysannats and in the diffusion of selected planting material [Drachoussoff, 1965]. The institute's fundamental research on the ecological environment and factors influencing plant growth and

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[9]In Belgium a good part of policy is implemented by "para-statal" organizations, a sort of national public service institution, legally granted a monopoly status, distinct from the state itself and with varying degrees of autonomy with relation to the central government. INEAC was such a type of institution. It depended directly from the Ministry of Colonies in Brussels.

[10]In 1970 INEAC changed its name to INERA, the National Institute for Agricultural Studies and Research, with headquarters at Yangambi, 60 miles west of Kisangani.

production is well known.[11] Table 3.2 illustrates the progress made by INEAC in the selection and breeding of cotton from its introduction in 1915 up to 1960. INEAC research on cotton was concentrated in the following stations:

1. Northern belt: Bambesa as the principal station for the Equator and Haut-Zaire region with the Boketa station in Ubangi assisting Bambesa.
2. Southern belt: Gandajika in Eastern Kasai for the entire southern zone.
3. Eastern zone: Lubarika, serving the Kivu and Ruzizi valley.

Edward Fisher introduced the American variety, Triumph Big Boll from Texas, in Zaire in 1915. This variety was diffused throughout Zaire, except for the Ruzizi valley where Allen Long staple was introduced. Triumph, the principal cotton variety for over twenty years, was purified by the Department of Plantations and later by INEAC through mass selection, and only plants well adapted to soil and climate were selected. No other variety proved superior or better suited for Zairean conditions for over twenty years.

In 1933 fusarium disease was accidentally introduced in Zaire with American seeds. Triumph was very sensitive to this disease. Its fiber length was also inferior to that in many other varieties and its ginning percentage was less than 33 percent, compared to 36 percent in the USA. COTONCO, the largest private cotton company, provided INEAC with several researchers to strengthen cotton research through which

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[11] In June 1960, INEAC employed 420 Europeans of which more than half were university graduates, and 12,000 Zaireans [Drachoussoff, 1965].

Table 3.2. Progress Made Through Cotton and Breeding Selection in Zaire[1]

Characteristics of Strains in General Use	Northern Cotton Zone				Southern Cotton Zone			Ruzizi Valley			
	Massal Triumph	270D64	Stoneville 5	Bambesa 49	Gar	C2	NC8	Allen Long Staple	14,125 1st Multiplication	14,125 Purified	1021
Year Introduced	1928	1935	1944	1958	1944	1955	1959	1923	1942	---	1960
Cotton Fiber Yield (Percent) Without Fertilizer	100	115	132	150	107	116	132	100	133	133	160
Ginning Percentage	34.0	34.6	35.3	36.3	35.0	35.5	37.0	32.8	36.6	37.7	38.5
Fiber Length (Inches)	29/32 to 15/16	15/16 to 31/32	31/32 to 1	1 1/32 to 1 1/16	15/16 to 1	31/32 to 1 1/32	1 1/32 to 1 3/32	1 1/32	1 1/16	1 1/16	1 5/32

[1]Derived from Table XX, p. 178-179 [Jurion & Henry, 1969]; technological characteristics (uniformity ration in fibers, microner index, arealometer finess, percentage of ripe fibers, Pressley index, number of neps and breaking length of thread) are also presented in Table XX.

INEAC bred and selected several important cotton varieties to combine resistance to fusarium disease, longer staples and higher ginning returns. The Bambesa station introduced the Stoneville variety from Mississippi after local adaptation and purification in the northern cotton belt. In the South the Gandajika station introduced GAR hybrids, from breeding Triumph with U4, imported from Transvaal, South Africa. Other varieties were diffused later, in the North, B49 and Reba B50 and in the South, C2 and NC8. At the Lubarika station, varieties adapted to the Ruzizi valley were developed and diffused: 14,125 and 14,125 purified and 1,021. All these varieties were resistant to wilt.

--In the North: Reba B50 replaces B49 and Stoneville. It was developed in 1960 by the French "Institut de Recherches du Coton et des Textiles Exotiques (I.R.C.T.)" on the Bambari station in the Central African Republic.[12] Presently, Reba B50 is grown on a large scale in northern Zaire, Central African Republic and Paraguay [Centurion et al., 1972 and Roux, 1974]. This variety was introduced in the Uélés in 1967 by Mr. Canivet, a COTONCO agent.

Reba B50 is genetically resistant to Bacteriosis (bacterial blight) and tolerates Fusariosis, diseases typically prevailing in humid areas. The ginning yield is also excellent; 37 percent in Central Africa, and staple length is 1 1/16 inches; other fiber characteristics are good. However, the main challenge facing INERA is to keep Reba B50 from degeneration; purebred seeds are not available in Zaire nor in the Central African Republic. A reduction in staple length from 1 1/16 inches

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[12] From a cross between Stoneville B 1439 and Allen 50 T.

to 1 1/32 inches was reported in 1974 indicating a loss of varietal purity which can be preserved by careful mass selection in isolated fields.

—In the South: NC8, replaced C2 in 1959. NC8 was developed at the Gandajika station and is characterized by longer but somewhat less resistant fibers.

—In the Ruzizi valley of the East: 1,021 which replaced 14,125 in 1960. This variety was developed at the Lubarika station.

Jurion and Henry [1969, p. 183] indicated the following maximum yields of seed cotton observed in intensive cultivation:[13]

	Yield in Kg. per Ha.
Forest central basin region	1,200
Derived savannah without cattle	1,200
Eastern mountain region	1,800
Eastern mountain region with total plant protection	2,700

In 1973 the major responsibility for cotton breeding and selection was concentrated in Gandajika. The Bambesa station limited itself to multiplication of Reba B50 seed, auto-fecundation of Reba B50 and BJA519 and determination of crop and ginning yields. In Boketa the influence of climate on selected cotton characteristics was studied and Reba B50 was multiplied on a large scale (5 hectares). Six other purebred varieties were also multiplied on a small scale (0.5 hectares).

INERA has come under the direct auspices of the Presidency since 1970. Previously, it had been controlled by the "Office National de la Recherche et du Développement" (ONRD) and, before that, by the Ministry

[13]The yields given are the highest obtained over several seasons on a fair-sized plot cultivated by advanced methods.

of Agriculture. Presently, the Department of Agriculture is linked with INERA in the direction committee (Comité Directeur) in which the state commissioner for agriculture and the director general of the Department of Agriculture have a major voice. However, it is clear that INERA has weak links with the agricultural extension service, a weakness which hampers the effectiveness of the research activities of INERA.

Paysannats and Cotton Production

After World War II a serious effort was undertaken by the colonial administration to rationalize and intensify agriculture. The dispersion and semi-nomadism of the population constituted a fundamental obstacle to agricultural development.[14] The beginning of a rural to urban exodus was a major reason for the establishment of paysannats in an effort to settle the farmer on the soil [Young, 1965]. Paysannats are farm settlement schemes which are organized around a new or regrouped village. An agricultural plan is prepared and land use, rotation and cropping patterns are specified and supervised by the agricultural service.[15] Fields are allocated and rotated in a systematic manner. Mechanization was feasible because all land plots were grouped in one block.

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[14] This semi-nomadism is typical of a system of shifting cultivation. There are two kinds of shifting cultivation: those who rotate land while staying in permanent villages and those who move and establish new villages after a period of years. The first kind is most common in Zaire. The Azande tribe in the Uélés of northern Zaire is known for moving from village to village [de Schlippe, 1957].

[15] On the average, there was one agent per 320 farmers in a paysannat [Young, 1965].

Paysannats are located along roads for easy transport of produce and easy access by the agricultural service.

The discipline required in paysannats included observation of rotations and fallow periods, use of better planting material, correct spacing of crops and timely planting. Often mechanization was tried and measures were taken to prevent soil erosion.

Cotton was the principal cash crop introduced in paysannats on an obligatory basis, and it became part of the food crop rotation. Table 3.3 illustrates the location and characteristics of paysannats with cotton as the main cash crop in 1957; of the 200 paysannats, over one-third were in Haut-Zaire region.

Paysannats were the cornerstone of the 1945-1960 agricultural development efforts of the colonial administration. They succeeded in many ways: yields in paysannats were well above yields outside paysannats, mechanization and new crops were introduced, erosion and soil fertility were controlled and generally, levels of living were improved. However, the ten year plan goal of 385,000 farmers by 1960 was not met as only 200,000 had been established by the beginning of 1959 [Young, 1965].

A fundamental problem of paysannats was that the agricultural plan was not organized around the economic and social objectives of farmers. The rigidities of the system had always been unattractive to the farmers. In fact, most paysannats disintegrated after independence when the European supervisory agricultural personnel left and when the government extension services deteriorated. Several government efforts are now underway to revive paysannats, the best known and most

Table 3.3. Location and Characteristics of Paysannats with Cotton as the Main Cash Crop, 1957[1]

Region	Number of Farmers	Total Cotton Acreage in Hectares
Haut-Zaire	65,000	482,000
Equateur	24,000	166,000
Kivu-Maniéma	28,000	258,000
Kasai	54,000	486,000
Shaba	29,000	261,000
Total	200,000	1,653,000

[1]Brixhe [1958].

successful of which is a project at Gandajika in Eastern Kasai. This project is receiving substantial aid from the FED. The Gandajika paysannat was one of the showpiece settlements of the colonial administration [Young, 1965].

Agricultural Extension

In the colonial period a large agricultural extension network promoted cotton production. The extension service consisted of government agents from the Ministry of Agriculture and the territorial service and agents from the private cotton companies.[16] There was an average of one Belgian agricultural officer for every 2,000 to 3,000 cotton farmers and one agricultural monitor (extension agent) for every 250 farmers.

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[16]After independence the private cotton companies continued at a reduced scale to provide technical assistance to the producers until COGERCO in 1970 ceased to refund expenses for this purpose.

In 1959 the number of cotton farmers was estimated at 800,000 and about 300 agricultural officers concentrated on cotton production. They were aided by an estimated 3,200 Zairean extension agents. Much of the extension work was concentrated in paysannats.

After independence the extension service, stripped of its European supervisors, rapidly disintegrated. Since independence extension agents have not been retrained. And although most do possess a bicycle, the supervisory staff lacks vehicles and travel allowances making it difficult to visit agents in the field. Many agents were not paid for months in the early 1960s, though this problem has now been solved with some exceptions.[17] An institutional constraint compounds these problems. Cotton farmers are visited by three different types of extension agents, (1) the Department of Agriculture (moniteurs agricoles), (2) the "Collectivités Locales" (moniteurs agricoles adjoints)[18] and (3) ONAFITEX (moneteurs coton).

These three types of extension agents are poorly coordinated.

The Agricultural Service of ONAFITEX

One of the objectives specified in the decree establishing ONAFITEX is to provide technical assistance to cotton farmers and to stimulate the formation of cooperative societies, capable of ginning and marketing their products (Article 2, Objective 1 and 4, Decree

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[17]Salaries of all government employees are now handled by the data processing center at the Department of Finance, using an IBM 370 computer.

[18]"Collectivités Locales" were formerly named "Secteurs" and are the smallest administrative units in the country. Usually they include several villages.

No. 71/077 of August 12, 1971). To this effect, the state commissioner of agriculture created an agricultural service in ONAFITEX on September 13, 1971 and a Zairois university trained agronomist was named director of this service. After an initial assessment of the agricultural problems confronting the cotton subsector, the service started a large scale pesticide treatment project to combat cotton diseases and insect attacks. As Brixhe [1958] stated, no other important crop is so much attacked by insects and diseases as cotton. Table 3.4 shows the efforts deployed by the agricultural service to fight cotton diseases. Yet the needs largely surpass the present capacity for pesticide treatments. For Ubangi only (north-west region), for example, it is estimated that 2,000 tons of pesticides and 1,000 sprayers are necessary for three treatments per crop and an average dose of 20 kg. per treatment.

The agricultural service of ONAFITEX also works closely with the agricultural extension service. However, this service depends largely from the Department of Agriculture and the local collectivities. Thus, ONAFITEX has no direct control over these agents, a fact which seriously handicaps the effectiveness of extension work by ONAFITEX. Recently, ONAFITEX hired additional extension personnel, especially supervisors, to improve its extension program. It is obvious that the agricultural service of ONAFITEX has an important role to play in the development of cotton production in Zaire.

Government Policies Affecting Cotton Production

One Channel Marketing Office

Before the creation of ONAFITEX on August 12, 1971, several private cotton marketing companies were buying and ginning cotton for

Table 3.4. Pesticide Treatments by the Agricultural Service of ONAFITEX, 1971-1972

ONAFITEX Regions	Shipment of D.D.T. Cotton Dust (In Tons)	Shipment of Pesticide Sprayers (Number)
North-West	700	520
North-East	700	480
South	605	60
Central	1,018	60
Uvira	100	62
Total	3,123*	1,182

*Only 1,500 tons were actually shipped to the different regions at the end of 1972.

[1]Agricultural Service of ONAFITEX.

COGERCO on a custom work basis (see Chapter IV). COTONCO was by far the largest company, covering about 90 percent of cotton production. These companies, under the leadership of COTONCO, did not compete with each other as each controlled a well delineated cotton growing area. They paid the farmers the official minimum cotton advance price. With the creation of ONAFITEX, a government controlled institution was set up with sole responsibility for buying, ginning and sale of cotton. ONAFITEX is a para-statal institution, a one-channel government marketing office with monopsony and monopoly powers. ONAFITEX was able to substantially raise seed cotton prices paid to the farmers.

Uniform Fixed Producer Prices

The decree of 1921 specified that minimum prices had to be paid to farmers.[19] The price was set annually on the basis of the prices obtained

[19]Article 10 of the Cotton Decree of August 1, 1921.

for cotton fiber in the previous year. The farmers also received salt in proportion to their production, and cash gifts were given to village chiefs who had actively participated in the cotton extension campaign.

Cotton prices fluctuated widely in the 1930s and in 1938 a price stabilization fund (Fonds de Réserve Cotonniére) was established. The seed cotton price paid to the farmer was derived from a potential cotton price which was determined automatically from a table with two entries: the average cotton fiber price realized in the preceding year and the total cotton fiber production of that year. The difference between the "potential" price and the price received by farmers was in large part deposited in the price stabilization fund (Fonds de Réserve).

The cotton decree of June 18, 1947 stipulated that cotton farmers retained ownership of their cotton until the final sale of cotton fiber. COGERCO (a Cotton Management Committee) acted on behalf of the cotton farmers until farmer cooperatives were formed to take over its functions. On delivery of his seed cotton, the farmer received an advance or down-payment which was eventually supplemented after the global results of fiber sales for the year were known, several months later.

The advance payment was based on the expected sales price of cotton fiber and marketing costs. Only in 1950, 1951 and 1952 did farmers receive a supplement. From 1953 on supplements were discontinued. Nevertheless, the stabilization fund increased its reserves considerably (reserves were 1,308,000,000 francs or 26,160,000 dollars on June 30, 1955) and spent large amounts of "cotton money" for road construction and maintenance, mechanization, creation of paysannats, cooperatives, purchase of small hand tools, etc.

G. Peeters [1958] criticized COGERCO for the large disparity between prices paid to farmers and prices received for cotton fiber in the world market and the utilization of the stabilization fund reserves for road construction and public works. Although COGERCO stabilized producer prices, the prices paid were extremely low. For example, the Zairean price was the lowest of all the countries for which price data could be obtained in 1970 and 1971 (Table 3.5). The 1947 regulations were effective until the creation of ONAFITEX on August 12, 1971 with slight modifications and additions in 1951, 1955, 1962 and 1965. Presently the management committee of ONAFITEX proposes the advance payment and the supplement to the state commissioner for agriculture (Minister of Agriculture). The evolution of the advance payment since 1950 is given in Table 3.6.

Seed cotton is paid according to quality. There are two grades--first and second--with about 90 percent of seed cotton classified as first quality. There has always been a uniform seed cotton price in Zaire, regardless of transport cost differentials between regions.[20] The principle of a flat seed cotton price favors cotton production in even the remotest or least accessible regions. Thus, cotton farmers in areas of low cost of production are actually subsidizing those growing cotton in high cost areas. This principle, "equal pay for equal work," is not followed, however, in the fixing of regional minimum wages.[21]

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[20] Only the seed cotton prices in the Kivu (Ruzizi Valley) and in Mahagi were always above the nationally set prices because of the superior qualities of cotton fiber (long staple) produced in these areas.

[21] Fuel prices are uniform throughout Zaire.

Table 3.5. Average Prices Paid for Seed Cotton in African Countries, 1970-1971[1]

Country	1970		1971	
	Makuta/kg.	U.S. Cents/kg.	Makuta/kg.	U.S. Cents/kg.
Zaire[2]	4.31	8.62	4.31	8.62
Central African Republic	5.40	10.80	6.00	12.00
Cameroun	5.76	11.52	6.40	12.80
Dahomey	5.04	10.08	5.60	11.20
Tchad	4.68	9.36	5.20	10.40
Ivory Coast	6.30	12.60	7.00	14.00
Uganda	7.72-8.40	15.44-16.80	. . .	. . .
Ethiopia	12.60	25.20	. . .	. . .
Nigeria	8.75	17.50	. . .	. . .

[1]ONAFITEX, Kinshasa and personal communications with students from African countries.

[2]Assuming 90 percent is first grade cotton and 10 percent is second grade.

Cotton Production Development Projects

In this section current development projects directly affecting cotton production in Zaire will be reviewed briefly. Presently, three cotton projects are underway:

1. The FED-CAK project in eastern Kasai
2. The CFDT mission to relaunch cotton production in the Equator region
3. The FIWA-BILI project of the Belgian Aid Mission in northern Ubangi.

Table 3.6. Republic of Zaire: Seed Cotton Price (Advance Payment) Fixed by the Government,[1] 1950-1975

Years	First Quality Cotton		Second Quality Cotton	
	Francs/kg. or Makuta/kg.[2]	U.S. $/kg.	Francs/kg. or Makuta/kg.[2]	U.S. $/kg.
1950-1951	5.50	.110	4.00	.080
1952	6.00	.120	4.00	.080
1953-1958	5.50	.110	4.00	.080
1959-1962	6.0	.120	4.00	.080
1963	8.00	.123	6.00	.092
1964-1966	18.00	.120	12.00	.080
1967	24.00	.151	16.00	.106
1968-1969[3]	3.60	.072	2.40	.048
1970-1971[4]	4.50	.090	3.00	.060
1972-1974[5]	6.50	.130	5.00	.100
1975-...[6]	7.00	.140	5.00	.100

[1]ONAFITEX, Kinshasa.

[2]Francs per kg. till 1967, Makuta per kg. from 1968 on.

[3]Arrêté 422/AE/0024 of October 7, 1967.

[4]From January 1, 1970 on.

[5]When ONAFITEX was created on September 11, 1971.

[6]Communication with Mr. Vandewalle, ONAFITEX in July 1974.

The FED-CAK Project in Eastern Kasai

This project started in 1968 in Gandajika and Kalenda-Kashile in eastern Kasai and is funded in a major part by the European Development Fund (FED: Fonds European de Développement). It is an integrated agricultural development scheme on a former paysannat, which is concentrating on cotton and food crops. The paysannats of Gandajika were created in 1954 and were among the most successful. The Gandajika population is dynamic and receptive to innovations. Before 1960 this area was known as the breadbasket (maize production) for the mining regions of Kasai and Shaba. The project is jointly managed by C.F.D.T. (Compagnie Française pour le Développement des Fibres Textiles), a French agency for technical cooperation specializing in the development of cotton production, and the Agricultural Commission of the Kasai (CAK: Commission Agricole du Kasai). The budget for the period 1968-73 was 1,875,000 Ƶ and the five year extension will cost 3,179,000 Ƶ, of which, 1,580,000 Ƶ is from FED, 466,200 Ƶ from the government, 284,000 Ƶ from ONAFITEX and 848,800 Ƶ from CAK.

The objectives of the project are the introduction of drying and insect control equipment for maize seed, the continuation of the agricultural program which was started in 1968 and the training of Zairois project management capable of taking over the project in 1978. FED also proposes the creation of a Regional Agricultural Development Office in Kasai. As demonstrated in Table 3.7, the 1969-1973 project objectives have been largely surpassed, except for groundnuts. The gross value of cotton and maize production increased from 255,600 Ƶ in 1968 to 1,472,500 Ƶ in 1972.

Table 3.7. Republic of Zaire: Objectives and Realizations of the FED-CAK Project, 1969-1973[1]

Objectives and Realizations	1969	1970	1971	1972	1973
No. Farmers in Project					
Objective	4,000	8,000	12,000	14,000	14,000
Realization	3,700	12,036	17,458	18,411	18,495
Acreage Maize (Ha.)					
Objective	4,000	8,000	12,000	14,000	14,000
Realization	---	15,000	19,550	22,270	---
Maize Production (Tons)					
Objective	2,600	6,000	10,000	12,700	13,700
Realization	---	12,000	16,300	20,000	19,519
Acreage Cotton (Ha.)					
Objective	1,000	2,000	3,000	4,500	5,500
Realization	2,120	6,100	10,241	10,135	---
Cotton Production (Tons)					
Objective	700	1,400	2,300	3,950	5,250
Realization	1,098	2,901	7,117	7,500	9,000
Acreage Groundnuts (Ha.)					
Objective	1,000	3,000	5,000	5,500	5,000
Realization	---	1,400	3,400	2,800	---
Groundnut Production (Tons)					
Objective	6,000	2,200	4,100	5,000	5,100
Realization	---	900	2,000	1,900	---

[1]C.F.D.T. [1972] and CAK-Commission Agricole du Kasai Oriental, "Relance Agricole des Paysannats de Gandajika et Kalenda-Kashile." Gandajika: Rapports Trimestriels, unpublished documents.

The FED-CAK project is characterized by a balanced, integrated "package" of technical innovations: improved seeds, fertilizers, pesticides, agricultural credit, tractor mechanization and improved small hand tools. These innovations are communicated to the farmers by trained agricultural extension workers.

A type of farmer cooperative, called "groupement de producteurs" was created for the sale of agricultural products, particularly manioc and maize, on the markets of Gandajika and Mbuji-Mayi. In these markets, manioc prices are 4 to 6 times the prices in local markets in the producing areas [Vasos, 1973]. The Agricultural Commission of Kasai provides transport services for the "groupement" at a charge of 8 K. per ton and per km. for a minimum of 6 tons.

The 1973 gross income per farm in the project was 154 Z, and the average net family income was 148 Z. On the basis of 300 working days per year, this amounts to 49.3 K. per day, which is almost double the minimum wage rate of 26 K. per day for unskilled labor in the Gandajika area.

The C.F.D.T. Mission to Relaunch Cotton Production in the Equator Region

In 1972 a technical assistance agreement was signed between the Republic of Zaire and the French government that called for a C.F.D.T. mission to work with ONAFITEX in order to relaunch cotton production in the Equator region.

In 1972-1973 the C.F.D.T. team included a team leader, university trained agronomist and three agricultural technicians. In 1974 two more technicians joined the project. The project objectives, broadly stated, were to develop cotton production in Ubangi and Mongala, mainly through improved agricultural extension work.

This project is a feasibility experiment for a much larger project covering most of the northern cotton belt in which the World Bank would take a major responsibility. The World Bank has already completed several pre-investment studies in the Ubangi and the Uélés and has held back action pending a reform of the cotton marketing institutional set-up.

A 1970 World Bank pre-investment study proposed to develop cotton production over 38,000 hectares in Ubangi and the Uélés by improving cropping practices, using fertilizers and pesticides, undertaking applied cotton research and good maintenance of feeder roads. The project cost was estimated at 7.2 million dollars over six years, half of the cost being in foreign exchange. The project returns were estimated at 27,170 tons of seed cotton per year, corresponding to a net increase in value of agricultural output at farm gate prices of 843,000 Z and foreign exchange earnings at full development of 4.5 million dollars per year. The rate of return to the economy was estimated at 25 percent.

Undoubtedly, the C.F.D.T. mission is pointing out the essential elements for increasing cotton production, the main obstacles being institutional. This project merits more attention on the part of ONAFITEX, the Department of Agriculture, INERA and the National University of Zaire. If the C.F.D.T. experiment proves conclusive, World Bank financing will probably be forthcoming.

The FIWA-BILI Project of the Belgian
Aid Mission in Northern Ubangi

Since June 1965, just after the rebellion, a team of eight to ten persons was given broad responsibilities for rebuilding the Ubangi and the Mongala sub-regions. The team started with purely administrative tasks such as overseeing salary payments of all government employees—including back pay, payment of pensions, reorganization of the territorial police force, opening of schools, etc. Other important achievements were repair and maintenance of roads and ferries, construction of houses, rehabilitation of a coffee paysannat in the Kungu territory. Moreover, over 100,000 coffee plants were distributed.

Beginning in November 1967 the team, responding to a demand from the government, abandoned its administrative functions and began engaging in rural development activities. They grouped the rural population in larger entities and promoted food crop and small animal production. Mechanization trials were set up first in FIWA and later in BILI. At the same time, a ranch was created in FIWA. Further, the agricultural stations of Bolo and Likimi were reactivated, and improved seeds of groundnuts, maize, rice, sesame and sorghum were multiplied and distributed to the farmers. Small farm tools were sold at cost to farmers.

Farmers pay 8 Ƶ per hectare for tractor plowing, half at plowing time and half at harvest. The operating expenses have been estimated at 6 Ƶ per hectare in 1972, excluding parts and repairs, and the total costs have been estimated between 15 and 20 Ƶ per hectare. With tractor plowing, average cotton field sizes increased from about 0.5 hectares to 1.0 hectares. The team also treated fields with pesticides (DDT cotton dust) with the spraying or dusting implements and the pesticides being donated by ONAFITEX. Cotton yields in Fiwa with tractor plowing and pesticides treatment are between 800 and 1,000 kg per hectare.

The main problem with this project is its lack of focus and orientation. The objectives of the project are broad and vague. Systematic agricultural extension is not an integral part of the project. No data have been collected on the economics of tractor mechanization or pesticide treatments. Counterpart training is neglected; only one university trained agronomist is working with the project but he is mainly concerned with the building of a cattle ranch. Thus, it is hard to evaluate the impact of this project.

Cotton Production in Northern Zaire

The area studied includes the following sub-regions of the Equator and Haut-Zaire region:

1. Equator region
   a. sub-region Ubangi; administrative center: Gemena
   b. sub-region Mongala; administrative center: Lisala
2. Haut-Zaire region
   a. sub-region Bas-Uélé; administrative center: Buta
   b. sub-region Haut-Uélé; administrative center: Tsiro.

Climatic Conditions

The climate in the northern cotton belt is tropical and humid with the main rainy season occurring from mid-July to mid-November and a short rainy season between March and half of June. Average annual rainfall is between 1,700 and 1,900 mm. with an average minimum temperature of 18° C. and an average maximum temperature of 30° C. During the short rainy season food crops are cultivated. Cotton is then planted after the harvest of food crops and is harvested during the main dry season from December to February. In the northern savannah the short dry season is less pronounced and cotton is grown as the first crop in the rotation. During the rainy season temperatures are relatively low and variations between day and night are about 10° C. In the dry season, however, temperatures are higher and fluctuate more, 14° to 16° C., which favors the maturing of cotton bolls. Thus, the climate is generally favorable for cotton production.

Soils

The northern cotton belt is to the North of the large equatorial rain forest and includes rain forest areas, savannahs and mixtures of both. INEAC has published detailed soil, soil utilization and vegetation maps for the Ubangi and Uélés [Jongen, et al., 1960; Jongen, 1968; and Frankart, 1960]. Generally, soils under forest coverage are more fertile than savannah soils since forest soils contain more organic material, have more humus, a better structure and better moisture retention. Nevertheless, depending on the location, cotton yields in some savannah soils may equal or surpass yields in forest soils.

The soils of northern Zaire are classified as ferralsols on non-differentiated rock. They are well suited for cotton production, but are fragile and rapidly lose their fertility if exposed to the elements. Some of the best soils of Zaire are found in this region. Certain parts of the Uélés (for instance, the Bambesa zone) are renowned for their good soils. However, poor soils are also common and, thus, there is a considerable variation in soil quality from one area to another.

It should be noted that cotton is very demanding on the soil and is known to exhaust tropical soils rapidly. Most of the cotton farmers are well aware of this.

Population and Demography[22]

Vansina [1965] estimates that there were about 250 ethnic groups in the Congo around 1900. The tribes of northern Zaire, where shifting cultivation is common, are predominantly of the Sudanese type, while the Ubangi is inhabited mainly by three different ethnic groups: the Ngbandi in the Mobaye area and to the East, the Ngbaka around Gemena and the Mbandja to the North and East.[23] In addition, several smaller enclaves of different tribes are found such as Buraka, Gbanziri, Ngbaga, Monjombo and Furu.

In the Uélés, the principal ethnic groups are the Zande in the northern savannahs and the Mangbetu and their neighbors, the Mamva and Mangutu, in forest areas, people who are known for their devotion to land cultivation. Zande agriculture has been studied in detail by de Schlippe [1956]. The Zande often move their homestead in search of fertile land and live in isolation or in small villages. The main crops of the Zande are millet, sorghum, maize, finger millet (eleusine), sesame, manioc, taro, yams, sweet potatoes, groundnuts, voandzea, beans, peas, gourds and ricinus. The Mangbetu, on the other hand, cultivate mainly oil palm, bananas and manioc.

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[22]This section is based mainly on Vansina's book: Introduction á l'Ethnographie du Congo, [Vansina, 1965].

[23]In the literature different ways of spelling are found: Ngbandi (Ngwandi); Ngbaka (Ngwaka, Bwaka); Mbandja (Mbanza, Banza). We follow Vansina [1965].

Table 3.8 depicts the demographic evolution of the four sub-regions and gives the results of the 1958 and 1970 censuses of population for each of the zones in the sub-regions.

Several zones in the Haut-Zaire region have low to negative rates of population growth because of disease, out-migration, infertility and a dominance of older people. The prevailing social structure in several tribes is polygynie with a large age difference between spouses.[24] Finally, we should not forget that the rebellion devasted this area.

Infrastructure

The northern region is drained by many navigable rivers such as the Ubangi, Mongala and Itimbiri that flow into the Zaire river, and unnavigable rivers such as the Uélé, Uéré and Ituri and a multitude of smaller ones. These waterways are linked with many bridges and ferries and are major bottlenecks for rapid and reliable road transport.

The Ubangi and Mongala sub-regions are served by a fairly dense road network feeding into the main embarkation ports of ONATRA, the national transportation office, on the Ubangi, Mongala and Lua River. On the Ubangi river ports of particular importance to the transport of cotton bales are Libenge (port of Batanga) and the upstream ports of Zongo, Pandu, Dula, Mobaye-Mbongo and Yakoma.[25] Ports on the Mongala

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[24] In the Zande and Mangbetu tribes girls become eligible for marriage at puberty or even before while men rarely marry before the age of thirty.

[25] The upstream ports are open 4 to 5 months a year, when the water level is high, and are served by a French shipping company operating from the Central African Republic.

Table 3.8. Republic of Zaire: Population of the Ubangi, Mongala, Bas-Uélé and Haut-Uélé Sub-Regions, 1958 and 1970[1]

Sub-Regions and Zones	1958	1970	Annual Rate of Increase	
			Predicted Natural	Effective Total
Sub-region Ubangi				
Gemena	187,003	264,584	3.3	3.1
Kungu	102,155	146,387	1.9	3.2
Libenge	86,072	108,965	1.6	2.0
Bosobolo	69,450	89,659	2.1	2.2
Budjala	108,216	167,385	2.6	3.9
Total	552,896	776,980	2.4	3.0
Sub-region Mongala				
Lisala	91,581	137,164	3.1	3.6
Bumba	168,432	235,618	2.6	2.9
Banzyville	97,936	118,772	2.1	1.7
Businga	97,508	132,356	2.8	2.7
Bongandanga	69,490	115,903	0.9	4.6
Total	524,947	739,813	2.4	3.0
Sub-region Bas-Uélé				
Buta	52,097	63,568	0.1	1.8
Bondo	109,686	174,277	-0.5	4.1
Aketi	85,912	82,984	0.7	-0.3
Ango	59,021	65,962	-0.7	1.0
Bambesa	78,549	85,404	-0.3	0.7
Poko	109,032	116,573	0.2	0.6
Total	494,297	588,768	-0.1	1.5
Sub-region Haut-Uélé				
Rungu	126,671	180,702	0.3	3.1
Niangara	67,964	60,345	-1.3	-1.0
Dungu	121,548	155,326	-1.1	2.2
Wamba	137,455	180,068	1.1	2.4
Watsa	69,428	93,433	0.1	2.6
Faradje	88,238	125,745	1.4	3.1
Total	611,304	795,619	0.1	2.3

[1]de Saint Moulin, L., 1971. "Les Statistiques Démographiques en République Démocratique du Congo." Kinshasa: Congo Afrique, 377-385.

river are Akula and Businga, and the Mogalo port is on the Lua river.[26] Several of these ports are operational during only the rainy season when the level of the rivers is high.

In the Uélés the road network is less dense than in Ubangi and Mongala, and cotton production is extended over a large area making collection and transport more expensive. A single track railroad network connects the main ginning plants with the port of Aketi on the Itimbiri river and Bumba on the Zaire river. The Aketi-Bumba portion of the railroad, completed only in 1973, bypasses river transport on the Itimbiri which was hindered by low water levels in the dry season. The Uélé railroad connects Mungbere, East of Isiro, with Bumba via Isiro, Buta and Aketi with extensions to Titule and Bondo. Despite service potential, however, the railway company, Vici-Zaire, which meets the area's needs, has been handicapped by poor management and organization, resulting in irregular service and undue delays.

A new railroad connecting Banalia with Kisangani is being planned. Although the main purpose will be to transport iron ore from Banalia, it may also serve to transport cotton to the new textile mill in Kisangani.

Most feeder roads are in a poor condition, a fact which is reflected in the high transportation rates charged by transport companies and the high cost of collecting and transporting seed cotton.[27]

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[26]On the Lua there is only shipping from July to December with barges with a maximum capacity of 400 tons.

[27]In April 1972 the Ministry of Agriculture increased transport rates per ton and per km. from 12.5 K. to 14 K. for hauling seed cotton, 7.5 K. to 11 K. for cotton fiber and 9 K. to 11 K. for cotton seed. These rates are considerably lower if return freight is available. The

Land Tenure, Crop Rotation and Cultural Practices

In Zaire, as in many parts of Africa, land has traditionally belonged to a lineage, a large family in which many members are dead, some alive and many more to be born [FAO, 1962]. In 1973, however, the Zairean government decided that all land belonged to the state. Farmers now have a usufruct right: they own all the crops and trees they planted. A farmer gains rights to a plot of land by putting it under cultivation, and he maintains his rights until he abandons the field [Harms, 1974]. Since population density is low throughout most of Zaire (9.2 persons per square km.), new plots usually are easily acquired. The present land tenure system does not constitute an obstacle to agricultural development [Lumpungu, 1973]. A land market does not seem to be functioning in Zaire.

The crop rotations recommended by ONAFITEX are:

—In forest areas:

1st year: March-April--planting maize
July 1-15--planting cotton

2nd year: March-April--planting maize, groundnuts or rice
July 1-15--planting manioc and bananas

3rd and 4th year: manioc and bananas

5th year and following: fallow.

—In savannah areas:

1st year: June 1-15--planting cotton

2nd year: March-April--planting maize or groundnuts

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handling of seed cotton at collection points costs 16 K. per ton; loading and unloading of trucks costs 20 K. per ton; and unloading of cotton seed costs 11 K. per ton [République du Zaire, Avril 1972].

July 1-15—planting manioc and bananas (with more manioc and less bananas than in forest soils)

3rd and 4th year—manioc and bananas

5th year and following--fallow.

In forest areas a pre-culture of food crops is necessary. This helps to clear the land and eliminates the excess nitrogen which stimulates vegetative development of cotton and hinders the development of cotton bolls.

R. De Coene [1956] of INEAC recommended the "Bafwasende" rotation for forest areas and Pennisetum savannahs. In this rotation manioc and bananas are the first crops, and rice can be grown between the rows of these crops. The recommended sequence of crops is as follows:

1st year: bananas with rice and manioc interplanted

2nd year: bananas plus manioc, beginning of harvest

3rd year: bananas plus manioc, end of harvest

4th year: March to June—maize, gourds or other local food crops
July to December--cotton

5th year: March to June--groundnuts
July to December—cotton

6th to 20th year: fallow.

This rotation was tested out in the Ubangi and the Uélés and proved satisfactory. H. DuBois [1957] confirmed the superiority of this rotation for the Bambesa region.

The recommended calendar for cotton is as follows:

—In forest areas:

Land clearing:	November to March
Land preparation:	March 1-15
Planting of maize:	March 15-April 15
Harvest of maize:	June 15-July 15

Planting of cotton:	July 1-15
Thinning:	July 20-August 5
Ridging:	July 25-August 10
Weeding:	August 20-October 5
Harvest:	December-January

--In savannah areas:

Land clearing:	January to May
Land preparation:	May 15-31
Planting of cotton:	June 1-15
Weeding:	June 20-July 5
Thinning:	June 20-July 5
Ridging:	June 25-July 10
Weeding:	July 25-September 10
Harvest:	November-December-January

Optimal spacing is 80 cm. between and 30 cm. within the rows with 6 to 8 seeds per pocket.[28] About 40 kg. of cottonseed is recommended per hectare. The first weeding should be done three weeks after planting, followed by two more weedings, a month apart. Thinning to two plants is done about three weeks after planting.

Harvest starts when the cotton bolls spring open. First quality cotton is kept separate from second quality. The harvest is dried in the sun on trays made with sticks and is stored in large hand woven baskets in a shed. Destruction of the cotton stalks, and hence the habitat of insects and fungi, after cotton picking has been compulsory in Zaire since 1921. For a detailed description of the cultural practices in cotton production, we refer to Brixhe [1958] or Van den Abeele and Vandenput [1956].

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[28] This should provide 41,625 pockets per hectare; in savannahs, often 60 cm. x 25 cm. is recommended.

Role of Cotton Production in Northern Zaire

Cotton is by far the most important textile fiber produced in Zaire (see Table 3.9). Other fibers produced in Zaire are Urena Lobata (African jute), agave-sisal, kapok, jute, raphia, manniophyton, punga, abroma, a.o.

The northern cotton belt has gained in importance since 1960. In 1959 the Ubangi and the Uélé cotton regions produced 42 percent of the total cotton crop and in 1973 they produced 50.6 percent (Table 3.10). In particular, Ubangi has become more important since Ubangi now contributes 19.0 percent of the total production as contrasted with only 9.6 percent in 1959. The largest relative drop in cotton production since independence occurred in Shaba, while the Sankuru sub-region in Kasai has increased its share from 1.8 percent to 4.5 percent. Finally, in 1964-1965, when the Congo rebellion was at its peak, the Equator region (Ubangi and Mongala) produced 42 percent of the national cotton crop.

The characteristics of pre-independence cotton production in the North and South are given in Table 3.11.

The evolution of cotton production in the Equator and Haute-Zaire regions of the northern zone since 1956 is presented in Table 3.12. This table shows that cotton production fell in the Uélés relatively more than that in Ubangi-Mongala. Thus, the potential for increasing cotton production in the Uélés is much higher than that in Ubangi-Mongala.

Table 3.13 reveals that production in the Mongala sub-region has decreased relatively more since independence than that in Ubangi. In fact, the decrease in the Equator region since 1959 is almost completely

Table 3.9. Production of the Principal Textile Fibers in Zaire (in Tons)[1]

Type of Fiber	1959	1966	1970	1971
Cotton fibers	59,280	6,590	17,250	19,930
Urena fibers	9,035	3,388	1,857	3,113
Punga fibers	2,828	2,622	1,993	961
Sisal fibers	263	216	. . .	. . .

[1]Ministère de l'Agriculture, 1968. "L'Agriculture Congolaise en Tableaux Statistiques." Kinshasa: Direction Etudes et Politique Agricole; Ministère de l'Agriculture et du Développement Rural, Avril 1970. Rapport Préliminaire 1959-1969. Kinshasa: Direction Etudes et Politique Agricole; République du Zaire, Novembre 1973. Conjoncture Economique. Année 1972 et Ier Trimestre 1973. Kinshasa: Ministére de l'Economie Nationale, No. 13, p. 18.

Table 3.10. Republic of Zaire: Production of Seed Cotton Per Cotton Region, 1959 and 1973 (In Tons)[1]

<table>
<tr><th>Cotton Regions</th><th>1959</th><th>Percent</th><th>1973</th><th>Percent</th></tr>
<tr><td>Ubangi</td><td>17,177</td><td>9.6</td><td>12,709</td><td>19.0</td></tr>
<tr><td>Uélés</td><td>58,018</td><td>32.4</td><td>21,178</td><td>31.6</td></tr>
<tr><td>Kivu</td><td>15,102</td><td>8.4</td><td rowspan="2">11,635</td><td rowspan="2">17.4</td></tr>
<tr><td>Maniéma</td><td>17,415</td><td>9.7</td></tr>
<tr><td>Nord-Shaba</td><td>19,943</td><td>11.1</td><td rowspan="2">6,319</td><td rowspan="2">9.4</td></tr>
<tr><td>Sud-Shaba</td><td>12,409</td><td>6.9</td></tr>
<tr><td>Kasai</td><td>35,992</td><td>20.1</td><td>12,090</td><td>18.1</td></tr>
<tr><td>Sankuru</td><td>3,038</td><td>1.8</td><td>2,984</td><td>4.5</td></tr>
<tr><td>Total</td><td>179,114</td><td>100.0</td><td>66,915</td><td>100.0</td></tr>
</table>

[1]ONAFITEX, Commercial Department, Kinshasa.

Table 3.11. Republic of Zaire: Characteristics of Cotton Production before Independence, 1954-1958 Averages[1]

Cotton Production Regions	Acreage Hectare	Yields Kg./Ha.	Production Tons	Percentage of Total Production
North	165,291	419	69,235	47.00
South and Central	182,717	430	78,069	53.00
Total	347,462	424	147,304	100.00

[1] Van de Walle, B., 1960. Essai d'Une Planification de l'Economie Agricole Congolaise. Bruxelles: INEAC, Série Technique No. 61, p. 65.

attributable to a reduction in Mongala where production is now only about one-fourth of the 1959 level.

Summary

Cotton was introduced in Zaire in 1918 as a required crop and it has remained so ever since. During the colonial period a dense agricultural extension network promoted cotton production, particularly in paysannats where cotton was the principal cash crop. Presently, however, the extension service is largely ineffective. The agricultural calendar is poorly observed, seeding is retarded, fallow periods are too short and many cotton fields are poorly maintained. Since independence extension agents have not been retrained; they lack travel facilities and are insuffiently motivated. To these problems is added an institutional constraint since the extension agents come under the auspices of three different institutions. The agricultural service of ONAFITEX now has its own extension agents who started large scale pesticide treatments on cotton fields in 1972.

Table 3.12. Republic of Zaire: Seed Cotton Production in the Northern Cotton Belt Per Region, 1956-1973 (In Tons)[1]

Year	Equator Region	Haut-Zaire Region	NAHV[2] Company	Total North
1956	18,929	55,477	---	74,406
1957	15,416	38,934	---	54,350
1958	15,583 & NAHV	39,869 & NAHV	4,066	59,473
1959	18,003	57,752	---	75,755
1960	14,198	50,357	---	64,555
1961	9,443	30,472	---	39,915
1962	7,604 & NAHV	14,012 & NAHV	1,566	23,182
1963	9,447 & NAHV	17,976 & NAHV	1,772	29,195
1964	7,261 & NAHV	21,923 & NAHV	2,260	31,444
1965	7,336 & NAHV	1,179 & NAHV	85	8,600
1966	6,397 & NAHV	2,342 & NAHV	679	9,418
1967	5,807 & NAHV	2,444 & NAHV	261	8,512
1968	5,284 & NAHV	11,527 & NAHV	220	17,631
1969	8,714	13,268	---	21,982
1970	11,155	9,023	---	20,178
1971	12,948	9,778	---	22,726
1972	6,346	11,127	---	17,473
1973	12,709	21,178	---	33,887

[1]Derived from seed cotton collection figures of the following companies: SACOUMO, COMACO, BELGIKA, NAHV and VINCHENT, ONAFITEX, Kinshasa.

[2]NAHV operated 5 ginneries: YAKOMA in Equator region and AMADI, LEBO, TAPILI and ZOBIA in Haut-Zaire. YAKOMA's reception never exceeded 1,000 tons of seed cotton. It was not always possible to split up NAHV's seed cotton reception between Equator and Haut-Zaire. Where this was not possible, NAHV's share appears separately.

Table 3.13. Republic of Zaire: Seed Cotton Production in Equator Region, Per Sub-Region, 1956-1972 (In Tons)[1]

Year	Ubangi Sub-Region	Mongala Sub-Region	Equator Region
1956	11,731	7,198	18,929
1959	10,644	7,359	18,003
1963	7,076	2,371	9,447
1967	4,383	1,424	5,807
1969	7,231	1,483	8,714
1970	9,377	1,778	11,155
1971	10,590	2,358	12,948
1972	5,445[2]	900	6,345

[1][République du Zaire, Avril 1972, p. 12].

[2]The sharp drop for Ubangi is attributable to a lack of rain in October 1971 and major insect damage, especially from helopeltis, acaridosis, dysdercus and the pink bollworm.

Since colonial times there has always been a uniform seed cotton price paid to farmers in Zaire. In 1970 the price of seed cotton paid to producers was the lowest of all African countries for which price data could be obtained. Presently, three cotton production projects are underway in Zaire: (1) the FED-CAK project in eastern Kasai which is an integrated "paysannat" development scheme; (2) the CFDT project in Ubangi-Mongala which has as its broad objective the development of cotton production mainly through improved agricultural extension services to small farmers. Presently, the project is engaged in varying research activities which are basically the domain of INERA and (3) the FIWA-BILI project of the Belgian Aid Mission in northern Ubangi which is concentrating on tractor mechanization and pesticide applications in cotton fields.

Ecological conditions in the North are well adapted to cotton production. Soils in the Uélés are generally better than those in Ubangi-Mongala. Land tenure is no constraint on cotton production. The cultural practices used by farmers are primitive and very labor intensive. The only source of power is human labor. Only simple hand tools are used and no fertilizers or pesticides are applied by the farmers.

Feeder roads are in a poor condition in northern Zaire. The Uélés railroad has been handicapped by poor management and organization.

The population in Ubangi and Mongala sub-regions is increasing at a rapid pace but several zones in the Haut-Zaire region have low to negative rates of population growth.

The northern cotton belt has gained in importance for cotton production since 1960. The Ubangi cotton region now contributes 19.0 percent of the total cotton production in Zaire as contrasted with 9.6 percent in 1959. The decrease in cotton production in the Equator region since 1959 is almost completely attributable to a reduction in Mongala sub-region where production is now only about one-fourth of the 1959 level. Cotton production fell relatively more in the Uélés than in Ubangi-Mongala. The potential for increasing cotton production in the Uélés is much larger than that in Ubangi-Mongala.

CHAPTER IV

COTTON MARKETING AND PROCESSING

The purpose of this chapter is to describe and analyze cotton marketing and processing in Zaire in order to diagnose the major barriers constraining the present system and to formulate policy recommendations for improved performance. A historical review of the cotton industry will provide background for a better understanding of the present cotton marketing structure in northern Zaire. The cotton seed crushing industry and the textile industry in Zaire will be briefly discussed as they are an integral part of the total sub-sector.

History of the Cotton Industry in Zaire

Development of the Cotton Industry

The first private cotton company, the Compagnie Cotonniére Congolaise (COTONCO), was founded in Zaire on February 10, 1920, and the first two ginneries were ordered by the government in the U.S.A. in 1917 and installed in Kibombo (Maniéma) and Lusambo (Sankuru) in 1921. In 1925 the first cotton textile mill was established in Kinshasa. From 1920 to 1930 several private cotton companies were created in Zaire, and by the end of 1937 there were 119 ginning mills installed in the country.

The first legal text referring to cotton production is the decree of August 7, 1918, specifying measures to protect cotton against diseases, to conserve fiber quality and to fix a minimum price for the purchase of seed cotton.

The decree of May 28, 1920 guided the organization of official markets for cotton and introduced cotton licensing. The license was contingent upon guarantees for adequate ginning and fiber quality. The decree of August 1, 1921 introduced reserve cotton areas for each mill equipped with mechanical cotton gins, and divided the cotton producing areas into geographical buying monopolies. Its purpose was to secure adequate supplies for each mill and to limit the maximum distance in each reserved area to 40 km. This limitation helped to reduce the distances which cotton farmers had to carry their seed cotton to the mill. On December 10, 1930 the delimitation of reserved buying areas became subject to the authority of the provincial governors.

In 1929 the Congolese Cotton Committee (Comité Cotonnier Congolais) was formed, bringing together representatives from all the cotton companies. This committee coordinated the efforts of the cotton companies, standardized work methods and acted as a lobby. It had a strong voice in the design and implementation of cotton policies until the creation of ONAFITEX in 1971.

The ordinance of October 31, 1935 introduced open areas for the newly developed cotton regions in which any one could buy cotton, subject to minimum price legislation and licensing. The purpose of this ordinance was to test an alternative to geographical buying monopolies. The ordinance of April 19, 1938 terminated this practice, however, because of fierce competition for cotton produced near railroads and abandonment of remote cotton areas. The quality of cotton fiber declined because of the mixing of cotton seeds of different quality.

The Fonds de Remploi: 1924-1935

In 1924 the governor general of Zaire was authorized to collect a cotton tax which would constitute a "Fonds de Remploi," or reinvestment fund, to be utilized for agricultural education and extension, cotton seed improvement and general agricultural development of cotton regions. In 1930 the tax was lifted because of adverse economic conditions, but it was reinstated in 1935 and in 1936 a price stabilization fund, "Fonds de Réserve Cotonnière" (Cotton Reserve Fund), was created to replace the "Fonds de Remploi."

The Cotton Reserve Fund: 1936-1942

The Reserve Fund was established by the government to stabilize seed cotton prices, improve road maintenance and distribute farm tools.

The seed cotton price was determined from a "potential" cotton price, and the Reserve Fund was credited with the difference between the "potential" cotton price and the actual price which farmers received. A two-way (baréme) table was used to determine the "potential" cotton price which could be paid to the farmer. The seed cotton price paid to farmers was computed by deducting the following from the potential price: cost of small farm tools and road improvement, contributions to local village chests, new taxes which increased the cost price of cotton ginners and deposits in the stabilization fund.

Banneux [1938], although favoring the "potential" formula, argued for a regular revision of the data used to calculate the "baréme" table in order to keep abreast of the changing economic and social situation. And, in fact, in 1941 the table could no longer be followed because of the special economic conditions created by World War II. A new formula for the calculation of the potential cotton price was adopted by the government and the private cotton companies in 1943.

COGERCO: 1943

In 1943 the Cotton Reserve Fund was brought under the management of a committee entitled the "Comité de Gérance de la Caisse de Réserve Cotonnière" (COGERCO). This committee was composed of four civil servants and two representatives from the cotton companies. Ordinance Nr. 182/Agric. of June 12, 1943 established a Cotton Reserve Fund.

The cotton companies bought seed cotton and financed their own operations. The potential formula was used to determine the remuneration of cotton farmers, "potential" referring to the price which theoretically could be paid to farmers after deduction of the following elements from the realized price of cotton fiber: export duty and per unit cost of the cotton companies including assembly, ginning, transport, storage, sales costs and profits. The potential formula was as follows:

$$P = (SF - ED) - (CG \times 1.15) - (P \times 0.15)$$

Where:

P = Potential

SF = Total receipts from the sale of cotton fiber

ED = Export duties

CG = Costs incurred by ginning mills after each campaign, including 6 percent interest on invested capital and depreciation charges

Thus, profits for the cotton companies were equal to $0.15(CG + P)$ or

15 percent of ginning costs, including transportation, and 15 percent of the potential. If the price paid to farmers was lower than the potential price, the difference was deposited in the Reserve Fund, if the price paid to farmers was higher than the potential price,then funds from the Reserve Fund were used to maintain the price to farmers. This formula was used, with various modifications in 1950, 1955 and 1962, until the creation of ONAFITEX in 1971. From 1940 to 1948 the Reserve Fund spent 3.28 million dollars on road improvement in cotton areas. All cotton areas received 0.20 fr. per kg. seed cotton annually for maintenance and improvement of roads, an amount which grew to an annual sum of 25 million francs.

The Cotton Decree of June 18, 1947

After World War II the geographical monopoly rights granted under the decree of August 1, 1921 expired, setting the stage for an overhaul of all cotton legislation. The 1947 cotton decree constituted the legal framework for post World War II cotton policies until the creation of ONAFITEX in 1971. The central feature of the 1947 decree permitted the cotton farmer to remain the owner of his crop until the final sale to domestic or foreign textile companies.[1] As a result, the role of private cotton companies was reduced to that of a contractor providing services to farmers until farmer cooperatives were able to take over their functions. The creation and transfer of ginning plants was made subject to government approval.

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[1]Most producers in Africa sell their cotton (with transfer of ownership) either to a cooperative society as in Sudan and Tanzania, to the government or a government marketing board (Egypt, Nigeria), to a marketing company such as CFDT in the former French colonies or to private companies (Ethiopia).

The remuneration of cotton companies was fixed by the governor general of Zaire by taking the following into account: the sales value of cotton fiber F.O.B. Matadi,the amount of seed cotton produced and the costs incurred by cotton companies. The "potential" formula was used to calculate the advance payment and the supplement to cotton farmers.

The Cotton Reserve Fund was given legal status and an independent budget. The Fund was managed by a management committee (COGERCO: Comité de Gérance de la Caisse de Réserve Cotonnière) composed of six civil servants and four representatives from the cotton companies. Each year COGERCO proposed and the governor general fixed the amount of advance payment to be paid to farmers upon delivery of their seed cotton, and decided upon the utilization of the remaining Fund balance after each cotton campaign.

The functions of COGERCO were as follows:

--Financing, through private cotton companies, the purchase of seed cotton from farmers at a fixed guaranteed price.

--Financing ginning and transport costs: refunding to cotton companies all expenses (on a cost plus basis) incurred in their activities.

--Supervision of sales of cotton fiber.

--Development of cotton production through the supply of improved seeds, insecticides, farm equipment, etc.

The 1947 decree became effective on November 15, 1949 in the Equator, Haut-Zaire and Kivu provinces and on December 1, 1951 in Kasai and Shaba. In 1950 the reserves of COGERCO amounted to 25 million dollars, and, over the 1951-1953 period a total of 12.84 million dollars was returned to farmers as cash bonuses and distributed according to their production.[2] Although from 1953 on cotton farmers never received a cash supplement beyond their fixed advance price, COGERCO continued to spend part of its surpluses for cotton development purposes, mainly maintenance and repair of roads and the hiring of extension workers to stimulate cotton production. The total disbursement of COGERCO between 1950 and 1955 was 32 million dollars. Because of depressed world market prices for cotton, COGERCO disbursed the following to support the seed cotton prices: 1.4 million dollars in 1957, 4.3 million dollars in 1958 and 5.1 million dollars in 1959. From 1950 to 1960, COGERCO reserves exceeded 20 million dollars but these reserves declined rapidly from 1960 to 1969 and only about one million dollars was left by 1969.

During World War II the Congolese Cotton Committee formed a pool for the sale of cotton fiber. The pool was quite successful, and on January 3, 1946 a central sales organization, COVENCO (Comptoir de Vente des Cotons du Congo) was established with its headquarters in Belgium. COVENCO had the legal status of a cooperative with the cotton companies as cooperative members and a representative from the governor general as watchdog. COVENCO received a sales commission of 2.75 to 3.00 percent on the F.O.B. Matadi price of cotton fiber. Then, with the convention of June 2, 1962, COVENCO became a mixed company, legally a non-profit making cooperative, 50 percent owned by COGERCO and 50 percent

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[2]The large surpluses were accumulated as a result of high world market prices for cotton fiber, especially in 1950, 1951 and 1952, the modest prices paid to the farmers.

by the cotton companies, with monopoly rights for the sale of Zairean cotton.

In 1949 224 European agents from the cotton companies were engaged, at least half of the year, in cotton extension.[3] The cost for these agents was included in the ginning cost and was paid indirectly by the farmers.

The Convention of May 30, 1950

The 1950 convention permitted farmers to remain owners of their crop until its final sale was consummated. The cotton companies became "service" companies and were remunerated on a custom work basis. COGERCO financed the purchase of seed cotton. The old potential formula was reinstated, although the profit rate was reduced from 15 to 13 percent. Since this formula was used until the end of 1962, a closer analysis is warranted.

The potential is the sum of money which can be paid to farmers for their production of seed cotton, after all expenses are paid for processing and marketing. It consists of an advance payment at the time of seed cotton delivery and a supplement, arrived at after all cotton bales are sold. This supplement could be used to pay farmers a bonus proportional to their cotton production or could be spent by COGERCO on economic and social development projects in cotton regions. If the advance payment exceeded the potential, COGERCO reserves were used to cover the difference between the advance and potential payment.

The following potential formula was adopted:

$$P = SF - ED - CG - 0.13\ (P + CG) \qquad (1)$$

[3]The allocation of agents by region was as follows: Kivu-19, Shaba-29, Kasai-50, Equator-38, and Haut-Zaire-88.

Where:

P = Potential

SF = Total receipts from the sale of cotton fiber

ED = Export duties

CG = Costs incurred by ginning mills as accounted for after each campaign. This cost includes depreciation charges but excludes the advance payment made to cotton farmers at the time of delivery of their seed cotton.

Thus, profit of the ginning mills was fixed at 13 percent of the potential plus ginning costs.

Formula (1) can be transformed as follows:

$$(P + CG) = SF - ED - 0.13\ (P + CG)$$

$$1.13\ (P + CG) = SF - ED \text{ or } P + CG = \frac{100}{113}\ (SF - ED)$$

Thus,

$$P = SF - ED - CG - \frac{13}{100} \cdot \frac{100}{113}\ (SF - ED) \text{ or}$$

$$P = SF - ED - CG - \frac{13}{113}\ (SF - ED) \text{ or}$$

$$P = SF - ED - CG - 0.115\ (SF - ED) \qquad (2)$$

We find that profits of the ginning mills were equal to 11.5 percent of the net sales value of cotton fiber with the net sales value equal to gross sales value (SF) minus export duties (ED). Profits are independent of ginning costs. When ginning costs increase, the potential decreases accordingly. Yet regardless of ginning costs, ginners realize their profits which depended only on the net sales value of cotton fiber.[4] The ginners benefitted directly from an increase in the world market price

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[4]It is assumed that for a given seed cotton production, there is no link between per unit ginning costs and the net per unit value of fiber exports.

of cotton fiber, and even when the world market price fell, their profits were still guaranteed at a fixed percentage of this price. As a result, ginners had no incentive to reduce ginning costs. However, ginners did have strong incentives to increase the net value of fiber sales by:

--higher seed cotton production

--improving the quality of cotton fiber to obtain higher per unit prices

--increasing ginning percentages

--reducing export duties

--increasing the sales price of cotton fiber.

This system permitted the cotton companies to overexpand and to overcommit resources in ginning plants. It also encouraged them to push for imposed cotton production in areas where, because of low yields, the cotton price did not offer a reasonable incentive to farmers. This process also explains why the companies financed extension work and agricultural research. Since COGERCO reimbursed all costs incurred by the ginning companies, every additional kg. of cotton produced increased the profits of the cotton companies, regardless of the cost of producing this additional kg. of cotton. The profits of the cotton companies have been excessive as Table 4.1 illustrates.[5]

If the remuneration of ginners had been set at a fixed amount per bale of fiber ginned, open to competitive bidding and annual review,

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[5]The cotton companies were not required to present a detailed breakdown of their costs to the government or to COGERCO. COGERCO or the government could not properly audit the accounting of the cotton companies. The governor general could only refuse to accept certain costs presented by the cotton companies to COGERCO for reimbursement.

efficiency would have been fostered.[6] Alternatively the profits of ginning companies could have been computed as a percentage of the difference between the net sales value of cotton fiber and the ginning costs.

Table 4.1. Republic of Zaire: Ginning Costs and Profits of the Cotton Companies, 1949-1952 (In Francs per Kg. of Lint)[1]

Year	Ginning Costs (CG)	Profit	Profit as Percentage of Ginning Costs (CG)
1949	8.4819	3.8633	45.55
1950	9.0920	4.1623	45.78
1951	11.4698	5.1311	44.74
1952	11.9158	4.5762	38.40

[1]Depy, G., 1954. "Etape de la Convention avec les Sociétes Cotonnières." Kinshasa, Unpublished document.

The Cotton Seed Convention of April 19, 1951

Prior to the convention of April 19, 1951, the crushing mills, on the basis of their balance sheets, were reimbursed for depreciation and received 6 percent interest on invested capital. The balance was equally spit between the Cotton Reserve Fund or the chiefdom which had produced the cotton seeds and the crushing mills. But it was the

[6]In French Equatorial Africa to the West and North of Zaire, the remuneration of the French cotton companies was determined by the decree of December 12, 1948 in which they shared 3 percent of the export price F.O.B. of cotton fiber and 15 percent of the difference between the export price F.O.B. and the cost paid by the companies, taxes included, with a maximum of 3 francs per kg. of cotton fiber exported. The cost paid by the cotton companies was also subject to the governor's approval. [Sladden, 1949] For Nigeria, Kriesel [1968] reported that the British Cotton Growing Association ginned, baled and classified cotton at a fee fixed annually on a per unit basis.

convention of April 19, 1951 between COGERCO, the government and the Congolese Cotton Committee (representing the cotton and cotton seed crushing industry) which determined how the value of cotton seeds and their derived products would be distributed between cotton farmers, owners of the seeds, and the cotton seed crushing industry. The oil mills pledged to process all cotton seeds except in areas where assembly and transport costs were prohibitive. The mills also agreed to finance the processing and to market the cotton seed products.

After each production season the profits and losses were equally split between the companies and COGERCO. In case of a net loss, COGERCO paid half of it. Table 4.22 shows that the crushing industry frequently closed its accounts in the red.

The Convention of January 31, 1955

This convention extended the use of the potential formula which was inaugurated in the early 1940s and formally adopted by the convention of May 30, 1950. However, the formula was only applied when the sales price F.O.B. Matadi (after deduction of export duties) was between 35 and 40 francs per kg. A separate calculation was made for the northern and southern cotton belt. The ginning costs used in the calculation of the potential were those of the COTONCO company except for transport costs which were secured from public transport companies (ONATRA or the railways).

COGERCO advanced the funds necessary for the purchase of cotton by the cotton firms. However, the firms financed the operations of transport, ginning, baling, storage, insurance, etc.

The COVENCO-Convention of June 2, 1962

This convention between the Zairean government, COGERCO and the cotton companies transformed COVENCO, the central sales organization of the cotton companies, into a mixed company with the legal status of a cooperative; it was owned 50 percent by COGERCO and 50 percent by the cotton companies. Thus, COGERCO, representing the cotton farmers, gained 50 percent ownership in COVENCO and reimbursed the cotton companies for the transfer of titles.

COVENCO transferred its corporate headquarters from Brussels to Kinshasa and retained monopoly rights for the domestic and export sale of cotton fiber. The proceeds from the sale of cotton fiber were distributed by COVENCO as follows:

1. Reimbursement of COVENCO operating costs.
2. Management fee for COVENCO
3. Reimbursement of costs and remunerations of cotton companies for reception, transport and ginning.
4. The remainder (if any) was transferred to the COGERCO stabilization fund.

The Convention of June 18, 1962

This agreement between COGERCO, the Congolese government and the cotton ginning mills updated the earlier agreements of 1955 and 1950. The 1962 convention restricted the role of the cotton companies to the cotton ginning phase (Phase 2), and until farmers' cooperatives were established, to the purchase and transport of seed cotton from farmers to the ginning mills (Phase 1). A new system of budget control for the cotton companies was also introduced by which the cotton companies had to present a budget plan before each campaign instead of presenting all costs to COGERCO after the campaign.

COGERCO loaned the cotton companies money for the purchase of seed cotton. Furthermore, the cotton companies were refunded all expenses incurred in the transport and ginning of cotton up to its delivery to transporters where COVENCO took over responsibility. In addition, the cotton companies were paid for their services by adopting a new formula for computing the potential:

P = SF - ED - CG - C.COVENCO - C.COGERCO

Where:

P = Potential

SF = Total receipts from the sale of cotton fiber

ED = Export duties

CG = Costs of ginning mills: this included four elements (see below)

C.COVENCO = Costs incurred by COVENCO for transport, insurance, management, etc. (See Convention of June 2, 1962)

C.COGERCO = Costs incurred by COGERCO for management and assistance to cotton farmers

The costs of ginning mills included the following elements:

1. all costs for transportation, ginning and baling accounted for by the cotton ginning mills after each campaign.
2. remuneration for the depreciation (amortization) of equipment and buildings equal to 2 percent of average sales price F.O.B. Matadi, export duties included, of cotton lint.
3. remuneration of capital employed according to a percentage calculated on the average sales price F.O.B. Matadi, export

duties included, of cotton lint. This percentage is between 2 percent and 4 percent and is calculated as follows:

$$\% \text{ rate} = \frac{\text{total seed cotton production in tons}}{110{,}000} \times 3$$

4. remuneration of management for the financing of the cotton ginning phase according to a percentage of the total costs accounted for by the cotton ginning mills (prix de revient industriel) as in (1). This percentage should be between 5 and 7 percent of total costs and is calculated as follows:

$$\% \text{ rate} = \frac{\text{total seed cotton production in tons}}{110{,}000} \times 6$$

Based on the realized production levels, only the rates of 2 percent and 5 percent were used.

Thus, the potential formula is:

$$P = 0.96(SF - ED) - 1.05\ CG - C.COVENCO - C.COGERCO$$

and profits of the ginning mills are equal to:

$$0.04(SF - ED) + 0.05\ CG$$

In the 1950 convention depreciation was determined by the ginning company and was included in ginning costs. In this formula depreciation charges are fixed at 2 percent of the average sales price F.O.B. Matadi, export duties included, per kg. of cotton fiber. The profits of the companies increased directly with ginning costs, regardless of the volume of cotton ginned. Thus, the ginning mills had an incentive to drive up ginning costs and to increase cotton production which, in turn, increased their relative share of cotton earnings. The cotton farmers, on the other hand, benefitted from lower ginning costs.

In making the percentage rate of remuneration of capital a function of the total seed cotton production, any production increase between 73,333 and 146,666 tons led to a higher relative and absolute return on capital. Similarly, any production increase between 91,666 and 128,333 tons led to a higher relative and absolute return to management and financing.

Depreciation and capital remuneration were a function of the sales price F.O.B. Matadi, export duties included. There was no sound basis for making depreciation and capital remuneration a function of the net export sales price. In fact, the companies applied their profit rate of 4 percent to the sales price of cotton fiber sold to domestic mills.[7] As usual, the cotton farmer was the receiver in last resort; he received what was left over after paying for all marketing functions, on a cost plus basis. The bargaining position of farmers was very weak vis-a-vis the cotton ginning companies who enjoyed a near-monopoly situation. It is then not surprising that compared with several African countries, the Zairean cotton farmer received the lowest price paid per kg. seed cotton, although the quality of Zairean cotton (strict middling 1 1/16 inches) is considered to be excellent (see Table 3.5).

On January 22, 1963 the Ministry of Finance provided COGERCO with an annual guarantee of 500 million francs of private bank loans for the purchase of seed cotton. On November 15, 1963 the Ministry of

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[7]Domestic mills paid about 25 percent to 40 percent more than the net export price. Because of large cotton fiber imports in 1965, 1966 and 1967 the government enacted a policy whereby domestic textile mills subsidized domestic cotton production.

National Economy decided to offer a 50 percent subsidy on the sale price of cotton lint sold to domestic mills. This had the effect of increasing the sale price of cotton lint to domestic mills by 50 percent, and raised the price paid to farmers (see Table 3.6) as well as encouraging cotton production in marginal areas. However, cotton production continued to fall until 1966.

The Decree--Law (Décrêt - loi) of August 13, 1965

This executive order focused on Zairisation of COGERCO management and it called for increasing participation of cotton farmers in the management of COGERCO.

The new COGERCO management committee was composed as follows:

1. 6 civil servants--secretary generals--of Ministries interested in cotton production
2. a minimum of 6 and a maximum of 11 representatives of the cotton farmers, nominated by the provincial governors
3. 3 representatives from the cotton companies
4. a president, proposed by COGERCO and nominated by the President of the Republic.

This decree reduced the influence of the private firms in designing cotton policies.

The Private Cotton Companies

COTONCO (Compagnie Cotonnière Cogolaise), a Belgian company, controlled eight cotton companies in Zaire and three vegetable oil (including cotton seed oil) companies. These companies controlled about 90 percent of cotton marketing in Zaire and operated 74 cotton ginneries with an estimated ginning capacity of 355,300 tons of seed cotton. COTONCO and seven other private companies in Zaire operated a total of 115 ginneries with an annual capacity of about 400,000 tons of seed cotton. Presently, however, only about 60 ginning plants are in operation with a total annual capacity of about 300,000 tons.[8] The number of cotton companies and the number of ginning plants and their location by the end of 1957 are shown in Table 4.2. Seed cotton production in 1973 amounted only to 66,915 tons; thus, less than one-fifth of theoretical ginning capacity is presently used. Since independence, the cotton companies have made very few new investments.

The Creation of ONAFITEX on August 12, 1971

Since COGERCO's losses were projected to be extremely high in 1970 the Ministry of Agriculture decided in 1970 to drastically reduce the budget for the cotton companies in order to reduce ginning costs. All firms were forced to accept the lowest rates for particular cost items, unless a firm could substantiate a higher rate. However, the cotton companies refused to accept budget restrictions, and on June 28, 1970 the Minister of Agriculture renounced the convention between COGERCO and the cotton companies.

The government established ONAFITEX (Office National des Fibres Textiles or National Office for Textile Fibers) under ordinance law

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[8]In 1958 a total of 353 technical assistance agents were paid by the cotton companies and reimbursed by COGERCO. In 1970 there were only 54 left, but they did not perform any extension work because COGERCO did not pay them for this service.

Table 4.2. Republic of Zaire: Cotton Companies, Number of Ginning Plants and Their Location in 1957[1]

Cotton Companies	Sub-Regions	No. of Plants
<u>Northern Cotton Belt</u>		
Belgika	Uélé	8
Societé Cotonnière du Bomokandi (Socobom)	Uélé	5
Nieuwe Afrikaanse Handels-Vennootschap (NAHV)	Uélé-Ubangi	6
Vinchent	Ituri (Mahagi)	1
COTONCO	Haut-Uélé	6
	Bas-Uélé	11
	Ubangi	11
Subtotal		48
<u>Southern Cotton Belt</u>		
Societé Cotonnière Coloniale (Colocoton)	Lomami-Sankuru	3
Campagnie Commerciale Belgo-Africaine (Combelga)	Lomami-Sankuru	3
Societé Cotonnière du Tanganika (Cotanga)	Tanganika	7
Compagnie de la Ruzizi	Sud-Kivu	1
Societé Cotonnière de la Luisa	Kais	1
Compagnie du Lubilash	Katanga	1
Societe Congolaise Bunge (Buncolo)	Haut-Lomami and Haut-Katanga	5
Societé Agricole, Commerciale et Industrielle du Kasai (Sacominka)	Kasai	1
COTONCO	Lomami-Kasai	11
	Sankuru	5
	Kivu	5
	Maniéma	7
	Dilolo	2
Sub-Total		52
Total		100

[1]Brixhe, 1958, p. 17.

No. 71/077 and ordinance No. 71/224 of August 12, 1971. ONAFITEX replaced COGERCO and COVENCO and terminated all previous cotton legislation and conventions. ONAFITEX combines all the different bodies concerned with cotton production, processing and marketing under a single organization. It was created as a public institution subject to the authority of the Ministry of Agriculture with monopoly rights for the marketing of seed cotton and its by-products and any other textile fiber.

The main purpose of the ONAFITEX reform was to reduce the profit margin of cotton companies and eliminating them if an agreement could not be reached. In that event they would be replaced by ONAFITEX until cotton farmers could assume responsibility for cotton marketing.

The ordinance-law empowered the Minister of Agriculture to authorize private companies, producer cooperatives or individuals to receive, gin and bale cotton on a custom work basis.

Under the ordinance-law the Minister of Agriculture fixes the advance payment to farmers at the time of collection of seed cotton while the balance is paid after the final sale of all cotton fiber. The balance is determined by ONAFITEX. The Ministry of Agriculture sets the sales price of cotton fiber to local textile mills after consultation with the Ministry of National Economy.

The new legislation charged ONAFITEX with the responsibility for Phase 1 of cotton marketing: collection of seed cotton at local assembly points and transport to the ginning plants. The cotton companies remained responsible for Phase 2: ginning, baling and transport of bales from ginneries to the pick-up points by public transport agencies. ONAFITEX then took over and arranged for the sale of cotton fiber to local textile firms or for export. The Zairean government negotiated a contract with the cotton companies for their Phase 2 operations. However, both parties could not agree on the amount of the custom work fee. The government first proposed 37 Zaires per ton of cotton fiber ginned and the ginneries finally agreed to 55 Zaires per ton. However, after only a month of work, the ginneries stopped all activities and demanded a higher fee. The government then intervened by taking over their facilities, supplies and manpower, both Zairean and expatriate.[9] (Law 72-006 and ordinance No. 72-235 of May 8, 1972 specified the terms of the requisition.) Ginners received 4 Ƶ per ton of cotton fiber for the use of their facilities, while their supplies were reimbursed at cost. Manpower was paid the same salary as before the take-over, but about 90 percent of the expatriate personnel were laid off, resulting in considerable savings.[10]

The principal reasons which led the government to a take-over (with compensation) of the facilities of the private cotton companies can be summarized as follows:

1. exhaustion of COGERCO reserves and imminence of bankruptcy of the cotton industry
2. government efforts to put the economy under Zairean control

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[9] Offices and houses of personnel of the cotton companies were also requisitioned, but cotton seed crushing mills were excluded and remained under control of the cotton companies.

[10] Savings in the order of 650,000 Ƶ per year were reported.

3. stubbornness of the cotton companies in yielding to government pressure for changes
4. inflation of ginning costs
5. slow Africanization of ginning management
6. lack of new investments in ginning mills since 1960
7. persistent losses of the cotton seed crushing industry (see section on "Cotton Seed Crushing"), 50 percent of which were borne by COGERCO
8. difficulty experienced by the government and COGERCO in controlling ginning costs because of the lack of knowledge of real processing and transport costs
9. conflicting incentives and interests placing cotton farmers and the government in opposition to the cotton companies
10. a levelling off of cotton production
11. private cotton companies generally ignored cotton legislation.

Structural Organization of ONAFITEX

The management committee of ONAFITEX is composed of a president, the director general, deputy director general, a representative from the ministries of agriculture, national economy, finance, foreign trade, transport, public works and interior, and two representatives from the cotton farmers. The management committee is appointed by the President of the Republic upon nomination by the Minister of Agriculture. Directors and regional directors of ONAFITEX are appointed by the Minister of Agriculture. Several special funds are set up by ONAFITEX. They are:

1. a renewal fund: for the replacement of buildings, installations, machinery and materials
2. an insurance fund: to cover costs resulting from fire, losses, damage
3. a training fund: for the retraining of personnel
4. a reserve fund
5. a provisions fund: to finance the purchase of equipment needed for the development of the activities of ONAFITEX
6. a price stabilization fund: to guarantee stable prices to cotton farmers.

The reserve and provisions fund are financed by appropriations from the annual net profits of ONAFITEX. ONAFITEX draws its income from the difference between the sales value of cotton fiber and by-products and the amount paid to cotton farmers plus all operating costs.

Role of ONAFITEX

The ordinance-law creating ONAFITEX requires it to promote the economic and social development of the regions interested in producing textile fibers. The roles assiged to ONAFITEX are to:

1. provide technical assistance to Zairean cotton farmers
2. assure collection, transport, ginning and sale of cotton and its by-products, belonging to Zairean farmers
3. assure financing of cotton marketing
4. organize cotton farmers into cooperative societies in order to gradually turn the responsibility for processing and commercialization over to them

5. acquire financial participation in companies which have a similar, allied or complementary role to that of ONAFITEX
6. conclude conventions with cotton companies in order to take over the processing of cotton or of its by-products
7. create a price stabilization fund for the purchase of seed cotton from farmers
8. control fiber quality and its conditioning for export
9. certify quality standards and origin for export
10. carry out any industrial, commercial, financial, real estate and other operations related to its role.

Cotton Marketing and Processing in Northern Zaire

Grading and Collection of Cotton

Seed cotton is graded by the farmer in two categories: first and second class. There is a significant price differential between these grades (see Table 3.6). About 90 percent of the Zairean seed cotton production is first quality. Second class is any seed cotton that is not white light creamy or contains impurities. It is recommended that farmers sort cotton while picking into two classes. However, many farmers sort only at home after the cotton is sun dried. Following the sun drying of seed cotton, it is then packed in large hand woven baskets which are stored in a specially made wooden shed. The baskets are then carried to the local collection points at the time of sale. They are emptied in large standardized bags or weighed in the original baskets. At this time, the buying agent inspects the quality of the produce. After weighing with a roman balance, the farmer receives his money and a receipt. Seed cotton is then transported by truck to the ginning mill.

ONAFITEX first buys up first grade seed cotton. The second buying period usually occurs one to three months later and both first and second quality cotton are purchased. Cotton seeds for the next season are distributed to the farmers at the same time.

In 1973, considerable time was lost in most collection centers because of a shortage of standardized bags. In the collection centers in Ubangi cotton is weighed in its original hand woven baskets.

On the average, only one truckload of 5 tons is received per day and per reception team. The C.F.D.T. mission in Ubangi reported that in Chad, Dahomey and Upper Volta a collection team could receive up to 120 tons per day, using a canvas spread out on a large scale on which the farmers dumped their cotton crop, up to 80 kg. of seed cotton per canvas. Several canvasses can be put on the scale at one time, thus weighing the farmer's total cotton crop. In Zaire each basket or bag is weighed separately and a sales receipt is issued after each weighing. Some farmers have several baskets and thus receive as many receipts. In 1973 33 collection teams operated in Ubangi.

In the northern cotton belt about 60 percent of the cotton is strict middling to good middling, average fiber 1 1/16 inches, white light creamy; 30 percent is strict middling, 1 1/32 inches white off-white to white light creamy; and 10 percent is middling to full middling, 1 1/32 inches, creamy dull to off-white grey.

Cotton is baled in the ginning plants by a hydraulic press which compacts the bales with pressures up to 320 kg. per cm^2. This assures a high weight to volume ratio and adequate protection from fire hazard. Each bale weighs 100 kg. and is packaged in a jute or synthetic fiber cloth with steel or nylon bands. Cotton bales are classified in the ginning mills in three qualities: superior, E and BA. Each category can be further divided into subcategories such as superior, average, inferior, etc. The commercial department of ONAFITEX (previously COVENCO) makes a final grading of the cotton bales according to universal grade standards and on the basis of a sample taken from each bale.[11]

Number, Size and Location of Ginning Plants

Most of the presently used gins were installed between 1945 and 1960, except those equipped with 60 saw gins which date back to before World War II. All gins are from Continental Gin Company, Prattville, Alabama (The Pratt Gin), with saws and usually pneumatic feeding.[12] The gin presses are all "Velghe" with one or two bins, with mechanic or steam operated rams.

In 1970 only 57 of the 115 gins were in operation as shown in Table 4.3. In 1974 67 ginning plants were in operation in Zaire, 11 in the North-West, 21 in the North-East, 33 in the South and 2 in the East and Uvira.

The number of ginneries in Zaire is relatively high and the scale of operation is low because of high transport costs for seed cotton due to the poor condition of feeder roads. And the higher the transport costs, the more gins are needed and the smaller the size of gins for optimal economic efficiency.

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[11]Fiber quality is determined by the grade (color, impurities and preparation), staple length and character (resistance and stretching as measured by a Pressley dynamometer) and fiber diameter as measured by the porosity and expressed in the micronary.

[12]Only the gin in Mahagi is of the roller type.

Table 4.3. Republic of Zaire: Situation of the Ginning Plants on September 1, 1970[1]

Company	Ginning Plants in Operation	Ginning Plants Closed Down
COTONCO	37	40
BELGIKA	1	9
NAHV	6	0
COTANGA	5	2
BUNGE	3	2
COMBELGA	2	1
COLOCOTON	2	2
Cie du LUBILASH	1	0
Soc. Cot. de la LUISA	0	1
SACOMINKA	0	1 (being reopened)
Total	57	57 + 1

[1] COGERCO, Kinshasa.

Economies of size are important in cotton ginning [Looney and Wilmot, 1971]. Ginneries with one 80-saw gin employ a crew of 10 workers while 14 are employed in two 80-saw gins and 17 in three 80-saw gins. However, labor is not an important cost element in ginning in Zaire as workers earn only between 30 and 50 Makuta per day (0.60 cents to 1.00 dollar per day). On the average, a crew of 14 workers produces 28 bales of cotton lint (2,800 kg.) per shift of 8 hours with two 80-saw gins.

Most of the ginneries presently in operation are in fairly good working condition. Equipment-wise, most ginning mills currently have delinters to separate linters from seeds, although these delinters are not being used because of the low export prices for linters.

In 1973 ONAFITEX received a special investment budget from the presidency and ordered 30 new, modern, high capacity gins from the U.S.A. Several of these are already being installed in Zaire. They are HARDWICK-ETTER gins, with 120 saws and a capacity of 7 bales (700 kg.) of seed cotton per hour, about double the capacity of a 90-saw Continental gin. These new gins cost about $30,000 each. There are indications however, that they are not well adapted to tropical African conditions as they are elctronically operated and require the drying of seed cotton.

The purchase of new gins seems unwarranted because ginning has not been a bottleneck in cotton marketing. Although the high cost of ginning depleted COGERCO reserves,this was mainly due to high transport costs and expatriate salaries. The ginneries still belong to the private cotton companies although they have been requisitioned by the government for a remuneration of 4 Z per ton of cotton lint.[13] Thus, the policy of ONAFITEX is in line with the "economic independence" policies proclaimed by the government.

Cotton Marketing Costs

Table 4.4 presents cotton production and marketing costs for 1957, 1958, 1959 and 1969, 1970, 1971. Total costs per kg. of cotton fiber are comparable between the two time periods listed. However, export prices F.O.B. Matadi were considerably lower in 1969-1971 and, as a result, COGERCO incurred losses. In 1973 and 1974 the export prices were more than double the 1969-1971 level.

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[13]For a production of 20,000 tons of cotton lint per year, this amounts to 80,000 Z for the cotton companies. This is only a small price to pay in comparison with the cost of acquiring new ginning equipment.

Table 4.4: Republic of Zaire: Cotton Production and Marketing Costs, 1957-1959 and 1969-1971 (Per kg. of Cotton Fiber)[1]

	1957 Francs/kg.	1958 Francs/kg.	1959 Francs/kg.	1969 K/kg.	1970 K/kg.	1971[2] K/kg.
1. Payments to Farmers[3]	14.45	14.30	14.30	11.97	11.97	11.97
2. Marketing Costs						
Phase 1[4]						
--COGERCO	13.95	13.00	11.50	6.34	4.97	5.84
--Cotton Firms	3.28	2.61	2.10	---	---	---
Phase 2[5]						
--Cotton Firms						
Costs	---	---	---	10.84	11.44	10.39
Fees	---	---	---	1.68	1.78	1.78
Phase 3						
--COVENCO	---	---	---	2.17	1.80	1.80
Subtotal	17.23	15.61	13.60	21.03	19.99	19.81
3. Total Cost at Matadi	31.68	29.91	28.01	33.00	31.96	31.78
4. Price F.O.B. Matadi	34.44	30.93	26.61	25.50	24.97	29.44

[1]Based on Volume 2, Table 4, Annex 6, I.B.R.D.-I.D.A., June 1972. "Agricultural Sector Survey, Republic of Zaire." Washington, D.C., Agricultural Porjects Department, P. 11.

[2]Estimated from 1971 cotton budgets submitted to COGERCO.

[3]Assuming 80 percent first quality and 20 percent second quality and a ginning rate of 35.1 percent.

[4]The division of marketing costs in Phase 1, 2 and 3 dates back to the 1962 convention between COGERCO and the cotton firms. Phase 1 comprises the purchase of seed cotton, assembly and transport to ginning plants; Phase 2 includes ginning, baling and transport of bales to COVENCO delivery points and transport of cotton seeds from ginneries to collection centers; Phase 3 comprises transport and storage of cotton bales, insurance, grading and final sale.

[5]Phase 2 costs are a weighted average of actual processing costs of 10 out of 15 firms as shown in published COVENCO accounts.

Marketing costs appear to be high. Cotton firms had no incentive to process cotton cheaply nor to employ their equipment at capacity as all costs were reimbursed and their fees were in proportion to their average total production cost.

The percentage distribution of costs incurred in cotton marketing for 1969 is shown in Table 4.5. Total cotton marketing and processing costs were composed of 34.63 percent fixed costs and 65.37 percent variable costs. Fixed costs are independent of the volume of production. By increasing processing volume per unit fixed costs decrease. Thus, one way of reducing marketing and processing costs is by increasing cotton production or vice-versa; one of the main reasons why cotton marketing costs in Zaire are high is because the processing volume is low relative to ginning capacity, staff, personnel and other fixed elements.

A further breakdown of cotton marketing and processing costs for 1969 is given in Tables 4.6 and 4.7. It appears from Table 4.7 that the cost of ginning firms represented 37.46 percent of total marketing and processing costs, more than the share attributed to cotton farmers, 33.54 percent. Salaries for personnel were high which is illustrated more clearly in Table 4.8 made up for 1971. Salaries totaled 37 percent of marketing and processing costs of cotton ginning firms in Phase 1 and 2. Expatriate salaries represented 18 percent of total costs, a cost element which ONAFITEX reduced considerably. As appears from Table 4.6 financing charges were also a substantial cost in cotton marketing because COGERCO had to borrow all of its funds from private banks for the financing of each cotton campaign.

Table 4.5. Republic of Zaire: Cotton Marketing and Processing Costs, 1969[1]

Sources of Marketing Costs	Costs in Zaires Per Ton	Percentage of Total Marketing Costs
COGERCO Costs: 11.9 percent fixed costs and 88.1 percent variable costs for management, financing, reception and transport of seed cotton from local assembly points to the ginning mills, called Phase 1 costs.	76.83	24.14
Costs Cotton Companies: Costs cotton companies consists of 70 percent fixed costs and 30 percent variable costs. Expatriate personnel account for a large part of the fixed costs. Costs for ginning, baling, storage, transport of cotton bales to public transporters and packing and transport of cotton seed to the local assembly points plus remuneration of capital, depreciation, financing charges and a management fee constitute the costs of the cotton companies, called Phase 2 costs.	119.39	37.46
COVENCO Costs: 9.33 percent fixed costs and 90.67 percent variable costs for management, insurance, storage, sales cost and transport of cotton bales to their final destination. This constitutes Phase III costs.	15.50	4.86
Cotton Farmers: 100 percent variable costs. Advance payment for the seed cotton crop plus payments in kind (tools, insecticides, etc.).	106.94	33.54
Total	318.66	100.00

[1]Nelis and Wieers [1969].

Table 4.6. Republic of Zaire: Breakdown of Cotton Marketing and Processing Costs, 1969[1]

	$/Ton Cotton Fiber	$/Ton Cotton Fiber	$/Ton Cotton Fiber
1. Phase 1: Reception and Transport of Seed Cotton from Local Assembly Points to the Ginneries.			
1.1 Fixed Costs			
Salaries of Personnel	13.37		
Travel Expenses	3.82		
Other Fixed Costs	2.88		
		20.07	
1.2 Variable Costs			
Purchase of Seed Cotton	104.40		
Reception of Seed Cotton	5.20		
Transport of Seed Cotton	38.23		
		147.83	
1.3 Financing Costs		11.67	
COGERCO Costs:			179.57
2. Phase 2: Ginning, Baling and Transport of Cotton Bales from Ginnery to Public Transporters; Bagging and Transport of Cotton Seeds from Ginnery to Local Assembly Points			
2.1 Fixed Costs			
Salaries of Personnel	40.26		
Travel Expenses	5.73		
Purchase and transport of Supplies	9.69		
Bagging and Transport of Cotton Seed	5.18		
Other Fixed Costs	10.32		
		71.18	
2.2 Variable Costs			
Ginning	5.00		
Baling	7.00		
Transport of bales	18.30		
Other Costs	0.11		
		30.41	
2.3 Depreciation (2 percent of export price F.O.B. Matadi):		6.36	
2.4 Capital remuneration (2 percent of export price F.O.B. Matadi):		6.36	
2.5 Management Fee (5 percent of CG):		5.08	
Cost Cotton Companies (CG):			119.39
3. Phase 3: COVENCO Costs: Transport of Cotton Bales to Textile Factories or Port of Export; Storage; Insurance			
3.1 Variable Costs			
		13.84	13.84
4. Management Costs:			
4.1 COGERCO		1.66	
4.2 COVENCO		1.66	
			3.32
5. Cotton Extension Costs:		2.54	
			2.54
Total Costs per Ton of Cotton Fiber			318.66$

[1]Nelis and Wieers, [1969].

Table 4.7. Republic of Zaire: Cotton Marketing and Processing Costs for Each of the Institutions Involved and for the Cotton Farmers, 1969[1]

Source of Costs	In Z/Ton of Cotton Fiber	Percentage of Total Cotton Marketing Costs
COGERCO Costs	76.83	24.14
Cost Cotton Companies	119.39	37.46
COVENCO Costs	15.50	4.86
Cost Cotton Farmers	106.94	33.54
Total Costs	318.66	100.00

[1]Derived from Table 4.6.

Table 4.8. Cost Structure of Cotton Ginning Firms in Zaire in 1971 (In Thousand Zaires)[1]

Type of Cost	Cotton Assembly (Phase 1)		Cotton Ginning, Baling and Transport (Phase 2)		Total Costs	Percentage of Total Costs
Fixed Costs of which	473.3		1,610.0		2,083.3	60
Salaries for Expatriates		227.9		424.3	652.2	18
Salaries for locals		109.9		557.0	666.9	19
Variable Costs	764.0		592.6		1,356.6	40
of which Transport		649.4		289.9	948.3	27
Total Costs	1,237.3		2,202.6		3,439.9	100

Note: Fixed costs comprise: wages, salaries, travel costs, equipment purchases, utilities, office supplies, transport of cotton seed; variable costs comprise: transport of seed cotton and cotton fiber handling and ginning costs, insurance, etc.

[1]I.B.R.D.-I.D.A., June 1972. "Agricultural Sector Survey, Republic of Zaire." Washington, D.C., Agricultural Projects Department, Vol. II, Annex 6, p. 13.

Salaries and transport costs together made up about 64 percent of total cotton marketing and processing costs in 1971 for Phase 1 and 2 (Table 4.8). This is usually high. The cotton companies were also engaged in commercial activities, plantation crops, ranching, etc. in addition to their cotton operations. Undoubtedly, a large proportion of personnel, especially expatriates, were assigned to noncotton departments and the transport facilities in the dead season were utilized for the commercial activities, but COGERCO paid for all these operations.

In Zaire in 1969, according to Table 4.6 and assuming that the final value of the cotton crop was equal to total cotton marketing and processing costs, 318.66 Ƶ per ton of cotton lint, the farmer's share was equal to 104.40 Ƶ plus 2.54 Ƶ for cotton extension or 33.54 percent.[14]

Transport costs represented 79.65 Ƶ per ton of cotton fiber in 1969 or about 25 percent of total marketing and processing costs, including the purchase of seed cotton. A breakdown of transport cost is given in Table 4.9.

Transport costs as a percentage of total cotton marketing costs were much higher for the Uélés (31 percent) for Ubangi and Mongala (21 percent); transport distances are much longer in the

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[14] In fact, the average sales price of cotton lint, domestic and for export in 1969, was equal to 308 Ƶ per ton (Table 4.15) or less than total cotton marketing costs. In Nigeria farmers realized 65 percent of the final value of their cotton crop, F.O.B. Lagos or local textile mills. The total costs for processing and marketing raw seed cotton and cotton seed were on the order of one-third of total farmer receipts [Kriesel, 1968].

Uélés because cotton production is spread out over a much longer area.[15]

Table 4.9 Republic of Zaire: Average Transport Costs in Cotton Marketing, 1969 (In Zaires per Ton of Cotton Fiber and as a Percentage of Total Cotton Marketing and Processing Costs, Including the Purchase Value of Seed Cotton)[1]

Source of Costs	Z/Ton of Cotton Fiber	Percentage of Total Cotton Marketing Costs
Phase 1: 38.23 + 2.66 (financing) =	40.89	12.8
Phase 2: 18.30 + 4.24 (cottonseeds)		
+ 2.38 (Supplies) =	24.92	7.8
Phase 3:	13.84	4.4
Total	79.65	25.0

[1]Drived from Table 4.6.

The regions with the highest transport costs per ton of cotton fiber actually produce the most cotton. This is particularly true for the Uélés which produce about one-third of the total seed cotton. Transport costs are very high because of the poor roads which account for high transport rates and the long distances involved in moving seed cotton and cotton fiber. Trucks often travel long distances to pick up small loads, and most of their runs are one-way pay-loads. Vehicle

[15]COGERCO, 1970. "Prix de Revient Industriel 1968/1969." Kinshasa: unpublished document.

life is usually short; amortization is over three years. And most trucks have only a five ton capacity. The transport rates for seed cotton range from 8 to 14 K. per ton and per km., on the average 12 K. in 1969. Rates for cotton fiber are usually lower, on the average 9 K. per ton and per km. in 1969.

The distance for seed cotton transport to the ginneries is on the average 106 km., implying a round trip journey of 212 km. [Nelis and Wieers, 1969]. At 12 K. per ton and per km., this amounts to 1,272 K. per ton or 1.3 K. per kg. of seed cotton or about 3.8 K. per kg. of cotton fiber. The trucks also distribute cotton seeds for the next campaign.[16]

In 1972 the World Bank indicated that road and rail transport rates in Zaire were very high, much higher than those in other African countries [I.B.R.D.-I.D.A., 1972]. By abandoning marginal production areas, overall transport costs could be reduced considerably. Another possibility is to pay lower producer prices in marginal or isolated areas to compensate for high transport costs from these areas.

Cotton fiber transported by ONATRA or VICIZAIRE is charged at the class E, luxury goods rate. In fact, the calculation of transport fares on public or semi-public transport facilities is complicated. The tariff sturcture has remained largely unchanged for over 30 years. The government controls transport fares and each company has exclusive transport rights in its territory [Huybrechts, 1970].

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[16]Wieers [1969] estimated that 11,000 tons of cotton seeds are distributed each year to the cotton farmers. Theoretically, this would be sufficient for a seed cotton production of 110,000 tons, far above present production levels.

Transport fares change according to the value of the product, type of product, distance, domestic price relative to world price, destination of the product (domestic use or export), inflation and other factors. ONATRA calculates the fare as follows:

$$F = M(B + T)\ (S + 1) + H$$

Where:

F = total transport fare

M = monetary coefficient

B = base rate

T = transit cost

S = sliding scale

H = handling cost.

The base rate B is the basic cost for transporting a good over a given distance. This rate is expressed in Congolese francs and has remained unchanged since independence. The base rate B also differs according to the classification of the product. For agricultural commodities, products are classified from A to E according to their unit value. Class A comprises the goods with lowest value per kg. such as maize, manioc, wood. Class E contains those with highest value per kg. such as cotton and coffee, the rate here being about twice that of Class A. Furthermore, the base rate declines on a ton-kilometer basis as distance increases. In general, the 600th km. costs only half as much as the first one. Thus, remote or isolated regions benefit from lower ton-km. rates to facilitate export of their products.

For agricultural commodities consumed in the country, the base rate is calculated for the entire distance from origin to final destination. If commodities are further processed at another location, as is the case for cotton fiber used in domestic textile factories, the base rate is taken from the origin to a point of transfer to the processing firm, and then recalculated from this point to the processing factory. This breaks up the distance in two parts and thus increases the ton-kilometer transport rate.

Transit costs T refer to charges for reloading goods when the mode of transportation changes, for instance from rail to river barge. Handling costs H are charges for loading and unloading the goods at origin and destination.

The sliding scale S provides a method of adjusting transport costs to monthly changes in world price levels of agricultural commodities. If the world price of a commodity rises above its July 1, 1960 level, then the transport fare for domestically traded goods rises as the world price of the commodity rises. This isolates the farmers somewhat from increases in world market prices for products that are exported.

The monetary coefficient M compensates for inflation since 1960. B, T and S are expressed in 1960 francs. Successive devaluations have reduced the franc to one-tenth of its value and, in 1967, the monetary unit was changed to Zaire and Makuta with one Makuta (called Likuta) equal to 10 francs. A monetary coefficient of 10 is applied for agricultural commodities to be exported, 6 for agricultural commodities used for industrial processes and 4 for agricultural commodities to be consumed locally. Thus, the rate structure favors domestically produced and consumed products and is biased against local processing and exports. In fact, products that are exported are charged a much higher transportation rate than for domestic use. For example, cotton bales for export are charged more than twice the rate of bales used in domestic textile factories. Thus, exports are penalized relative to locally consumed goods [Wieers, 1969].

The fare bears little relation to the actual cost of transport. Cotton, classified in Class E, pays well above real transport costs and compensates for losses incurred on the transport of Class A and B commodities. This is particularly important for rail transport as rail fares are on the average three times higher than river transport fares [Van de Velde, 1974].

The Uélés produce about one-third of the Zairean cotton crop. And because of its remote location, transport and handling costs are among the highest in Zaire. Cotton produced in the Uélés is brought to the local assembly points in large baskets, carried on the head. From there it is transported in bulk with trucks to the ginning mills. Cotton bales are then transported by truck from the ginning mills to the Mungbere-Bumba railroad. In Bumba the bales are trans-shipped from railcars to river barges for transport to Kinshasa. If the bales are for export, they are again put on railcars in Kinshasa for transport to the port of Matadi. This description of transportation chain illustrates why transport and handling costs are high for cotton produced in the Uélés. The opening of a large textile factory in Kisangani will considerably improve the economic efficiency of cotton marketing in the Uélés.

ONAFITEX does not publish its balance sheets nor cost accounts and, thus, marketing costs from 1971 on are not known. However, the director general of ONAFITEX reported that there have been major savings in cotton marketing since the establishment of ONAFITEX:[17]

—a considerable reduction in labor costs, mainly through lay-offs of expatriate personnel who formerly worked for the cotton companies. Ninety percent of the expatriate staff and technicians were fired.[18] This also included the elimination of of representation costs of the cotton companies in Kinshasa and in Europe of over 110,000 Ƶ in 1970.

—reduction of transport costs from 14 K. to 8-12 K. per ton and km.

—financing costs were reduced by repayment of outstanding loans for the buying up of seed cotton, cotton ginning and transport after nine months instead of twelve.

—reduction of baling costs from 13 K. per bale to 6 K.

The establishment of ONAFITEX, however, also created some new problems. For example, the buying period of seed cotton in 1972 and in 1973 was extended over almost the whole year instead of the usual three to five months. The main problems were (a) the inability of the ONAFITEX office in Kinshasa to adequately supply funds to its regional branches, (b) seed cotton production projections were underestimated, (c) poor transport facilities[19] and (d) difficulties with the transfer of facilities from the cotton firms to ONAFITEX.

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[17] Remarks by the director general of ONAFITEX at a 1973 cotton conference at the National University of Zaire, Kinshasa campus.

[18] Savings in the order of 650,000 Ƶ per year were reported.

[19] Most of the vehicles used by Vici-Zaire in the Uélés for transport of seed cotton were acquired before 1960.

Since the collection of seed cotton was spread out over the year, trucks and vehicles were in operation for a full year. Some trucks were making frequent runs of more than 100 km. for a payload of one-third or one-fourth of load capacity in one-way.[20] Thus, transport and salary costs were excessive.

The Evaluation of the Textile Industry

The first textile company in Zaire (UTEXCO) was created in 1925, and in 1928 the first textile mill went into operation. Three other companies opened a textile mill during or shortly after World War II. Presently, four companies spin and weave cotton in Zaire and a fifth mill (SOTEXKI) is starting production. Most of the textile mills also dye and print a large part of their production, and several have clothing manufacturing shops attached to the mills. Since 1950 two companies also spin and weave urena and punga fibers, mainly for bags used for the export of coffee, groundnuts, palm kernels, and for carpets, strings, tarpaulins, etc. Blankets are produced by two companies.

Presently, the Zairean textile industry is well developed and consumes about 16,000 tons of cotton fiber or three-fourth of the domestic cotton production.[21] In 1966 Lacroix [1967] estimated that 80 percent of the Zairean textile imports could still be replaced by domestic production and thatcotton fiber consumption would then increase to about 30,000 tons per year, more than the present production. Since

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[20]One regional director made it a point of honor to buy up every quintal of seed cotton produced in his region, whatever the cost of hauling it.

[21]In Nigeria the first modern textile mill began operation in 1957. During 1968 it was estimated that the domestic use of cotton was equal to the domestic output of lint [Kriesel, 1968].

1972 a British company (CPA) produces "wax" textiles, 16 million square meters in 1973, which are in great demand in Zaire. In 1972 2.3 million square meters of textiles were produced from imported synthetic fibers.

The major textile mills in Zaire are located in Kinshasa, with other mills in Lubumbashi, Kalemie and Kananga. Tables 4.10, 4.11 and 4.12 provide statistics on the Zairean textile industry.

Of particular interest to the northern cotton belt is the opening of a large mill in Kisangani in 1974. The mill will initially consume about 3,500 tons of cotton fiber per year from the Uélés and will produce about 18.5 million square meters of textiles annually. The mill has 456 looms, 24,000 spindles and will employ 1,100 workers.

Table 4.10. Production of Cotton Textiles in Zaire, 1968-1972 (In Thousand Square Meters)[1]

Year	Natural Colored and Bleached Textiles for			Source of Material for Printing		
	Direct Sale	Printing	Total	Local Production	Imports	Total
1968	26,887	28,865	55,572	28,865	7,632	36,497
1970	35,078	34,049	69,127	34,049	9,968	44,017
1971	38,733	36,789	75,522	36,789	15,265	52,054
1972	35,369	37,546	72,915	37,546	21,437	58,983

[1] République du Zaire, Novembre 1973. Conjoncture Economique, Année 1972 et Ier Trimestre 1973. Kinshasa: Ministére de l'Economie Nationale, Nr. 13, p. 245.

Table 4.11. Equipment in the Zairean Textile Industry, 1973[1]

Company	Number of Spindles	Number of Looms
Utexco	70,084	1,382
Filtisaf	16,660	360
Amato	10,000	196
Solbena	10,000	198
Sotexki	24,000	456

[1]République du Zaire, op. cit., 246-250.

Table 4.12. Republic of Zaire: Domestic Sales of Cotton Fiber to Textile Companies, 1970-1974

Company	1970	1971	1973	1974[2]
Utexco	8,400	8,400	8,350	9,000
Filtisaf	1,700	1,700	3,000	3,000
Amato	1,200	1,200	1,200	1,200
Solbena	1,800	1,800	1,800	2,000
Zaitex	200	200	500	600
Sotexki	---	---	---	1,200
Total	13,300	13,300	14,850	17,000

[1]ONAFITEX, Kinshasa, Commercial Department.

[2]Estimated, based on current contracts

Note: Data for 1972 per company were not available; total domestic sales were 11,649 tons.

Sale of Cotton Lint

About three-fourths of Zairean cotton production is used in domestic mills. The rest is exported, mainly to the common market countries of Europe (Table 4.13). Cotton fibers are the principal textile fibers exported in Zaire (Table 4.14).

Since 1962 Zairean cotton lint has been sold to domestic spinners at a higher price than for export. This premium price was designed to cover COGERCO's deficits. In 1965, 1966, 1967 and 1968 Zaire had to import cotton lint from the U.S.A. at a price of 369 $ per ton to satisfy domestic needs. Zaire started exporting cotton again in 1968. However, from 1968 until ONAFITEX took over the operations of COGERCO and COVENCO in 1972, the average price received from the sales of cotton fiber, domestic and export, was below the average total cost of production, estimated at 320 $ per ton in 1970 (Table 4.4). To counter these losses, several measures were taken. On December 14, 1968 exports of cotton fiber were exonerated from export duties (3 percent) and from the turnover tax of 7.50 percent.[22] On November 15, 1969 the Ministry of National Economy decided to increase the price of cotton lint sold to domestic mills by 25 percent in order to safeguard COGERCO reserves and to support local cotton production. Thus, local textile mills were penalized in order to subsidize exports. In fact, the Ministry of National Economy fixed the sale price of cotton lint to domestic textile factories on the basis of the anticipated export

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[22]The government still collects some minor taxes on exports:
--statistical tax: 1 percent
--selection tax: 1.60 K. per 100 kg.
--cotton tax: 0.60 K. per 100 kg.

Table 4.13. Exports of Zairean Cotton Fiber Per Country of Destination, 1970-1973 (In Tons)[1]

Destination	1970	1971	1972	1973
Belgium	1,843	3,511	2,440	3,015
France	1,082	---	61	377
W. Germany	2,075	253	366	356
Netherlands	1,302	677	1,024	754
United Kingdom	824	881	191	371
Italy	80	26	122	771
Japan	1,004	658	261	633
Hong-Kong	645	50	---	546
Total Exports	8,855	6,056	4,465	6,823

[1]ONAFITEX, Kinshasa, Commercial Department.

Table 4.14. Exports of the Principal Textile Fibers in Zaire, 1959-1971 (In Tons)[1]

Fibers	1959	1965	1970	1971
Cotton Fibers	52,790	89	8,806	5,429
Urena Fibers	2,947	3,220	3,153	461
Punga Fibers	1,193			
Sisal Fibers	100	166	. . .	. . .

[1]Ministére de l'Agriculture, 1968, op. cit.,; Ministére de l'Agriculture et du Développement Rural, Avril 1970, op. cit.,; République du Zaire, Novembre 1973, op. cit.

price F.O.B. Matadi after deducting all duties and taxes. The 25 percent surcharge was added to this so-called "export parity price", and the theoretical transport costs from Matadi to the local textile industries were deducted to arrive at the sale price to the local textile factories. The average prices of cotton fiber paid by domestic textile factories are given in Table 4.15. These prices remained remarkably stable over the 1964-1973 decade. The average export prices F.O.B. Matadi and the overall average sales price of cotton fiber for domestic use and for exports are also shown in Table 4.15. The purchase price of cotton lint from the farmers as a percentage of the export price F.O.B. Matadi over the 1950-1973 period is presented in Table 4.16. This ratio fluctuated widely over the years. When the world market price dropped, the farmers' share in the export price increased and vice-versa which illustrates the role played by the price stabilization fund. For 1974 the percentage again declined because of rising export prices for cotton lint.

In 1973 and 1974 world market prices for cotton lint reached unprecedented heights (see Tables 4.17 and 4.18). However, domestic prices remained relatively low (see Table 4.18). Thus, the policies from 1968 to 1972 whereby the Zairean consumer supported the local textile industry and local cotton production have been reversed. Local fiber prices are now kept low to protect the Zairean textile industry and the purchasing power of Zairean consumers.

Since January 1, 1974 sale prices for domestic textile mills are fixed ex-cotton ginnery and thus, transport costs from ginning mills to local textile factories are paid by the textile company. The

Table 4.15. Republic of Zaire: Average Sales Price of Cotton Fiber for Domestic Sales and for Exports, 1964-1973 (Price in K. per kg. of Cotton Lint)[1]

Year	Domestic Sales Price in K. Per kg.	Export Price, F.O.B. Matadi in K. per Kg.[2]	Weighted Average Sales Price in K. per kg.
1964	34.96	. . .	. . .
1965	34.22	. . .	. . .
1966	34.76	. . .	34.76
1967	22.54	. . .	22.54
1968	32.60	. . .	32.60
1969	34.81	25.50	30.80
1970	34.81	24.97	29.76
1971	34.14	29.44	32.62
1972	34.15	33.48	33.97
1973	34.99	36.70	35.52

[1] ONAFITEX, Commercial Department, Kinshasa.

[2] This price includes export duties; in 1957, 1958 and 1959, the price was respectively 34.44, 30.93 and 26.61 K. assuming 1 Belgian franc = 1 Likuta.

charges for handling, transport and storage are about 6 K. per kg. of cotton fiber. Previously these charges were supported by ONAFITEX.

Looking at the domestic market for locally made textiles, one notes that the prospects for expansion are bright. Houyoux [1973] undertook a cross-sectional survey of 1,471 Kinshasa families in 1969 and found that on the average clothing represented 7.3 percent of total expenses and had an income elasticity of 2.33 (see Table 4.19). Low income groups spent only 1.7 percent of their meager income on clothing and 79.9 percent on food, while high income groups spent 9.6 percent of their income on clothing and 56.8 percent on food (see Table 4.20).

Table 4.16. Republic of Zaire: Purchase Price of Cotton Lint from Farmers in Percentage of the Export Price, F.O.B. Matadi, 1950-1973

Year	Average Purchase Price of Seed Cotton[2] in K. per kg. (I)	Average Purchase Price of Cotton Fiber in K. per kg.[3] (II)=(I)x3	Average Export Price, F.O.B. Matadi, of Cotton Lint (III) in K. per kg.	Purchase Price in Percentage of Export Price (IV) $IV=\frac{(II) \times 100}{(III)}$
1950	5.35	16.05	40.28	39.85
1951	5.35	16.05	52.14	30.78
1952	5.80	17.40	47.34	36.76
1953	5.35	16.05	37.22	43.12
1954	5.36	16.09	39.07	41.08
1955	5.35	16.05	39.70	40.43
1956	5.35	16.05	34.09	47.08
1957	5.35	16.05	34.44	46.60
1958	5.35	16.05	30.93	51.89
1959	5.80	17.40	26.61	65.39
1960	5.80	17.40	28.56	60.92
1961	5.80	17.40	30.62	56.83
1962	4.44	13.32	32.84	40.74
1963	6.00	18.00	39.40	45.69
1964	4.83	14.50	33.24	43.62
1965	4.83	14.50	35.22	41.17
1966	4.83	14.50	35.77	40.54
1967	3.22	9.67	24.90	38.84
1968	3.48	10.44	36.27	28.78
1969	3.48	10.44	25.50	33.68
1970	4.35	13.05	24.97	52.26
1971	4.35	13.05	29.44	44.33
1972	5.85	17.55	33.48	52.42
1973	5.85	17.55	36.70	47.82

[1]COGERCO, unpublished document dated 9/8/1969 and own calculations.

[2]Assuming 90 percent of seed cotton is first quality and 10 percent is second quality.

[3]Assuming 3 kg. of seed cotton yields 1 kg. of cotton lint.

Note: Conversion rates until 1960- 1 franc - 1 K; from 1960 to 1967 conversion at the official exchange rates assuming 1 USA$ = 50 Belgian francs = 50 K.

Table 4.17. Average Cotton Fiber Price in New York 1959-1973 (In U.S. cents/lb. and K./kg.)[1]

Year	Fiber Price in U.S. cts/lb.	Fiber Price in K/kg.
1959	34.57*	38.11
1963	38.83*	42.80
1964	32.44*	35.76
1965	30.37*	33.48
1966	24.98**	27.54
1967	23.28**	25.66
1968	27.65**	30.48
1969	25.41**	28.01
1970	25.69**	28.32
1971	29.67**	32.71
1972	35.12**	38.72
1973:		
1st Semester	44.37**	48.91
2nd Semester	76.41**	84.23

[1] Banque du Zaire, Rapport Annuel, 1967; 1969/1970; 1972/1973 and Bulletin Trimestriel, 4 ème Trimestre 1973, Kinshasa.

* C.I.F. New York

** Contract Nr. 2

Table 4.18. Republic of Zaire: Comparison Between July 1974 Cotton Fiber Prices for Export and for Domestic Use (In K. per kg.)[1]

Type of Cotton[3]	Average Staple Length	Export Price, F.O.B. Matadi in K. per kg.	Domestic Price[2] in K. per kg.
Reba B50 GM to full GM	1 1/16"	81	45
Reb ler SM to full SM	1 1/16"	80	44
STO ler Special SM to Shy SM	1 1/32"	79	44
Rebel M to full M	1 1/32"	76	42

[1]ONAFITEX, Kinshasa, Commercial Department.

[2]This price includes 6 K/kg. for transport, handling and storage from the ginnery to the textile factory.

[3]Cotton fibers from the northern cotton belt.

Table 4.19. Income Elasticities in Kinshasa, 1969[1]

Expenses for	In Percentage of Total Expenses	Income Elasticity
1. Food	67.4	0.78
2. Housing	14.9	1.21
3. Miscellaneous	10.4	1.53
4. Clothing	7.3	2.33

[1]Houyoux, J., 1973. Budgets Ménagers, Nutrition et Mode de Vie à Kinshasa. Kinshasa: Presses Universitaires du Zaire, p. 111.

Table 4.20. Structure of Monthly Expenditures per Family in Function of Income in Kinshasa, 1969[1]

Income in Zaires	Number of Persons/Family	Expenses for Food		Expenses for Lodging		Expenses for Clothing		Expenses for Miscellaneous		Total Expenses	
		Z	%	Z	%	Z	%	Z	%	Z	%
< 15 Ƶ	4.5	8.76	79.9	1.36	12.4	0.18	1.7	0.66	6.0	10.96	100
15 - 19.99 Ƶ	5.2	13.59	77.1	2.32	13.2	0.48	2.7	1.24	7.0	17.63	100
20 - 24.99 Ƶ	5.8	16.75	74.5	2.96	13.2	0.81	3.6	1.97	8.7	22.49	100
25 - 34.99 Ƶ	6.0	20.88	71.4	3.52	12.0	2.14	7.3	2.71	9.3	29.25	100
35 - 59.99 Ƶ	6.9	29.57	66.4	5.49	12.3	4.52	10.2	4.93	11.1	44.51	100
> 60 Ƶ	8.4	56.28	56.8	20.20	20.4	9.51	9.6	13.05	13.2	99.04	100
Total	5.9	21.19	67.4	4.68	14.9	2.30	7.3	3.25	10.4	31.42	100

[1] Houyoux, J., *op. cit.*, p. 111.

It is also interesting to note that females spent more on clothing than males in all income groups except the lowest.

Consequently, when personal incomes increase over time, expenditures on clothing and, thus, the effective demand for textiles will increase more than twice as fast as income. Although this study was undertaken only in Kinshasa, the results should be substantially the same for rural areas.

Before the petroleum crisis in 1973 and 1974, it was expected that the world demand for cotton would expand mainly through the growth in population. Man-made fibers were most likely to benefit from increased per capita textile consumption as a result of rising living standards. Cotton's share in world fiber use in 1968 was estimated at 57 percent and was predicted to drop to 47-48 percent in 1980 because of competition from man-made fibers [Magleby and Missiaen, 1971]. Because of the rapid increase in petroleum prices the price of synthetic fibers has increased significantly and, as a result cotton lint is now competitive with textile fibers. However, this also led to an upward pressure on world cotton prices. Since May 1972 world market prices for cotton lint have been increased from 36 U.S. cents per lb. C.I.F. Liverpool to 87 U.S. cents in February 1973 for strict middling 1 1/16 inches and 84.5 U.S. cents on December 21, 1973.[23]

The domestic textile factories in Zaire are using larger and larger quantities of cotton and, if cotton production stagnates, no fiber will be available for export in the near future. Since Zaire

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[23]Cotton Outlook Supplement, C.I.F. Liverpool quotation for principal growths, Liverpool Cotton Services Ltd., Liverpool.

is a very small cotton exporter in relation to total world cotton trade, it is reasonable to assume that no difficulties will be encountered in disposing of increasing cotton production. Moreover, Zaire is a price taker and a quantity adjuster in the world market for cotton.

Cotton By-Products

The ginning process divides seed cotton into about one-third of the weight in cotton lint and two-thirds cotton seed. The 1973 utilization of seed cotton is presented in Figure 1. In 1959 the sales value of cotton lint in Zaire represented 90.7 percent of total cotton receipts; cotton seed oil made up 4.1 percent and cotton meal and cake, 5.2 percent.

Distribution of Cotton Seed to Farmers

Of the seed production, 35 to 40 percent is returned to the farmers for planting in the next seasons by way of seed distribution to them during the purchase of second quality cotton. The seeds are not sorted according to weight and are not treated with an insecticide-fungicide.[24]

For an average yield of 300 kg. seed cotton per ha., 200 kg. are seeds. On the average, 40 to 50 kg. seeds are needed per hectare or 20 to 25 percent of total seed production. Zairean farmers receive an excess of seeds and they use this surplus as organic fertilizer or burn the seeds to produce smoke which keeps away insects and baboons from the fields.

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[24]The C.F.D.T. mission in Ubangi-Mongala recommends sorting plus treatment with an appropriate seed disinfectant; this could increase yields by an estimated 10 percent.

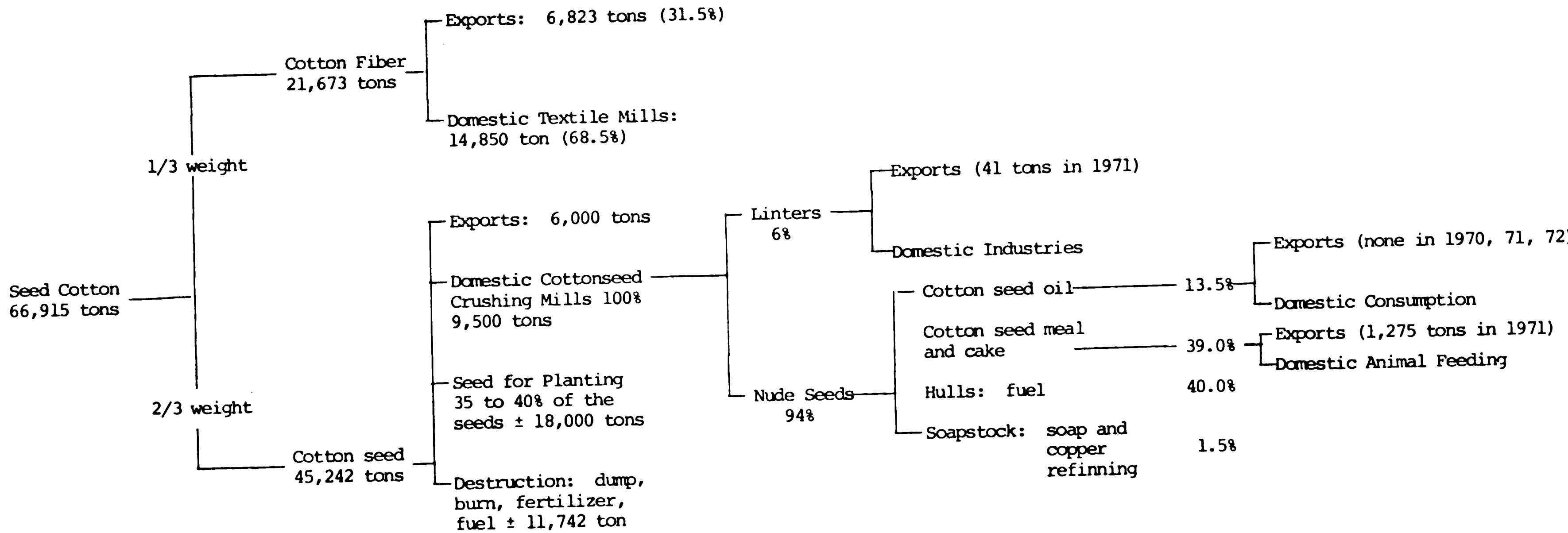

Figure 1. Republic of Zaire: utilization of cotton and its by-products, 1973.

Source: Huilco, Lub Umbashi and République du Zaire, Novembre 1973.

<u>Cotton Seed Crushing</u>

Between 1936 and 1938 three cotton seed crushing mills were created in Zaire and currently most of them are located along a navigable river or railroad. Most mills have large storage facilities. It was only after World War II that the crushing mills prospered because of increased demand for cotton seed oil and meal. For example, between 1950 and 1960 all of the seeds not used for planting were processed for oil. In 1958 ten cotton seed crushing mills were active in Zaire, 6 of them under COTONCO control with 71.4 percent of total capacity (see Table 4.21). In 1959 Zaire exported 629,000Z cotton seed oil and 780,000Z cotton seed meal.

All cotton seed oil extraction in Zaire is done with mechanical expellers after the seeds are cooked. The linters are separated from the seeds before expelling the oil, and are used for the manufacturing of blankets, bandages, etc. Remote ginning mills use the cotton seeds as fuel, sell the seeds to mining companies as fuel, or simply burn the seeds.

Cotton seed oil, after deodorizing and neutralization, is used domestically, especially for the production of margarine. Cotton seed meal and cake are used locally in cattle feeding and are exported mainly to Zambia and South Africa.

Cotton seed flour might be of special interest in supplying needed protein to the population. Generally, the Zairean diet is adequate in calories but lacks protein. Cotton seed flour could be mixed with starchy foods such as manioc or bananas to upgrade the diet. The processing of cotton seed meal into flour for human consumption, however, requires the removal of gossypol, a toxic phenolic pigment. Such removal is said to be economically feasible [Hirsch, 1971].

Table 4.21. The Status of the Cotton Seed Crushing Industry in Zaire, 1958[1]

Company	Localization	Daily Seed Capacity in Tons	Yearly Seed Capacity in Tons[3]
Huiloo (C)[2]	Lubumbashi (Shaba)	60	15,000
Huiloo (C)	Samba (Mamiéma)	45	11,250
Huiltinda (C)	Isiro (Haut-Uélé)	60	15,000
Huiltinda (C)	Tinda (Bas-Uélé)	60	15,000
Cotonco	Businga (Mongala)	30	7,500
Bunge	Tende (Kasai)	10	2,500
Combelga	Kabinda-Kamukungu (Lomami)	20	5,000
Colocoton	Lodja (Sankuru)	8	2,000
Colocoton	Katanda (Lomami)	12	3,000
Vinchent	Mahagi (Ituri)	10	2,500

[1]Brixhe, op. cit., p. 130.

[2]The (C) indicates that these companies are controlled by Cotonco.

[3]Based on 10 months of operation per year and 25 days per month.

There are three cotton seed crushing mills in the North: the Businga mill for Ubangi and Mongala, located along the Mongala river, the Tinda (Aketi) mill for Bas-Uélé and the Isiro (Gossamu) mill for Haut-Uélé, both located along the Mungbere-Bumba railroad. The Isiro mill was closed shortly after independence because of a lack of seeds. The Businga mill was shut down in 1968. Since 1969 only two major oil mills have been operative in Zaire, Tinda for the entire North and Lubumbashi for the South and Central.

Since independence the financial results of the cotton seed crushing industry have been negative (see Table 4.22 and 4.23). And,

Table 4.22. Republic of Zaire: Total Losses of the Cotton Seed Crushing Industry, 1963-1969 (In Francs or in Zaires)[1]

Year	Loss in Francs or in Zaires
1963	24,844,607 Fr.
1964	14,686,675 Fr.
1965	10,861,155 Fr.
1966	24,713,866 Fr.
1967	72,060.95 Ƶ
1968	224,200.58 Ƶ
1969	75,596.74 Ƶ

[1]COGERCO, Kinshasa.

Table 4.23. Republic of Zaire: Losses of the Cotton Seed Crushing Mills, 1968-1969 (In Zaires)[1]

Location of the Mill	1968	1969
Tinda	101,843	38,872
Businga	49,153	12,502
Lubumbashi	60,343	833 (profit)
Samba (idle)	12,862	25,056
Total	224,201	75,596.74

[1]COGERCO, Kinshasa.

since the cotton decree of 1947, cotton fiber and seeds, after ginning, have remained the property of the cotton farmers until the moment of final sale. The convention of April 19, 1951 imposed obligatory cotton seed processing for the ginning companies, except where transport costs to the oil mills were prohibitive. It also specified a 50-50 distribution of profits and losses between COGERCO and the cotton companies. From gross sales, production costs, sales costs and amortization charges were deducted and the balance was shared 50-50 by the cotton firms and COGERCO.

It is difficult to understand why private firms would maintain an operation which is unprofitable for more than a decade. However, the nature of the losses explains this seemingly irrational behavior.

Total cotton seed processing per mill for the 1963-1969 period is presented in Table 4.24. Since 1964 several oil mills were left idle or operated far below capacity because of insufficient cotton seeds. However, COTONCO and the other cotton companies continued to deduct depreciation charges for these mills.

The Lubumbashi mill is a modern mill which produces first quality cotton seed oil for human consumption (see Table 4.25).[25] In 1973 the mill paid 14 Z per ton for cotton seeds. The mill processes most of the seeds from Shaba, Mamiéma, Kivu and Kasai. On January 29, 1972 ONAFITEX fixed the price for cotton seeds at 1.50 K. per kg. for seeds within a radius of 300 km. from the mill and 0.75 K. for seeds outside this radius.

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[25] For cotton seeds with 20 percent oil, extraction rates of 16 percent and above are realized by modern mills. Cotton seeds in Zaire contain an average of 18 percent oil.

Table 4.24. Republic of Zaire: Tons of Cotton Seed Processed Per Mill, 1963-1969 (In Tons)[1]

Year	Lubumbashi	Businga	Tinda	Kabinda-Kamukungu
1963	4,258[2]	3,380	9,164	792
1964	2,986[2]	1,935	3,432	124
1965	3,897[2]	---	---	---
1966	3,474[2]	1,493	---	---
1967	3,307[2]	1,221	4,503	---
1968	1,838[3]	1,628[4]	3,156	---
1969	8,965	---	6,647	---

[1]COGERCO, Kinshasa.

[2]From July 1st to June 30th of the next year.

[3]From July 1st to December 31st of the same year.

[4]From September 1st to December 31st of the same year.

Table 4.25. Production of the Lubumbashi Cotton Seed Crushing Mill, 1939-1972 (In Tons)

Year	Cotton Seeds Processed	Cotton Oil Production	Meal and Cake	Linters
1939[1]	6,665	677	2,729	310
1945[1]	8,379	940	3,365	287
1950[1]	13,296	1,446	5,649	758
1955[1]	17,241	2,036	6,596	723
1959-1960[1]	21,998	2,462	3,117	1,135
1964-1965[1]	6,577	627	2,578	428
1968[2]	8,052	601	3,044	327
1969[2]	15,612	2,007	6,142	842
1970[2]	12,011	1,295	4,741	633
1971[2]	13,427	1,983	5,170	656
1972[2]	9,821	1,324	3,548	402

[1][Lumpungu, Kamanda, Novembre 1970, p. 78].

[2][République du Zaire, Novembre 1973, p. 61].

ONAFITEX did not requisition the cotton seed crushing mills and does not own any, but it did sell the seeds directly to the mills or exported them. On November 30, 1973, President Mobutu announced that all agricultural plantations, ranches and angro-industrial complexes had to be owned by Zairean nationals. Thus, the cotton seed crushing mills were taken over by the government and distributed to Zairean nationals who have ten years to reimburse the original owners if the acquisition proves profitable.

The construction of a high capacity oil extraction mill in Gemena for COMINGEM (Combinat Agro-Industriel de Gemena) is significant for the Ubangi-Mongala area. This mill will extract oil by pressure and then with solvents. It represents an investment of 13.2 million dollars, 65 percent from a Zairean industrialist (Moleka), 25 percent from the Zairean government and 15 percent from Krupp-Holm from West Germany. Twelve hundred workers will be employed by the mill. In Table 4.26 the availability of cotton seeds over the 1970-1972 period is given. Seed cotton production in Ubangi-Mongala is expected to increase slowly, but not at a rate which will satisfy COMINGEM's demand for cotton seeds. It is possible to bring in cotton seeds from the Uélés, but the transport cost will probably be prohibitive as COMINGEM is located about 115 km. from the nearest port (Akula). With this new mill, it is evident that the Businga mill will remain inactive. The Businga, Tinda and Isiro crushing mills are old mills, with outdated equipment and a low oil extraction rates.

Table 4.26. Availability of Cotton Seeds in Ubangi-Mongala, Republic of Zaire, 1971-1973 (In Tons)[1]

Year	Seed Cotton Production	Cotton Seed Production	Seed Requirements	Available Cotton Seeds
1971	12,950	7,770	2,100	5,670
1972	6,350	3,810	2,300	1,510
1973	12,000	7,200	2,700	4,500

[1]C.F.D.T. Mission, Gemena.

Exports of Cotton Seed

In 1973 Colocoton processed 1,500 tons in Lodja and Katanda, Huilco processed 8,000 tons in Lubumbashi, and the rest of the cotton seeds were destroyed or exported: 3,000 tons to Japan and 3,000 tons to Greece. All of the seeds not needed for planting were burned in the Uélés as the railroad could not assure transport of the seeds to the mill in Tinda. The railroad company Vici-Zaire had only two locomotives in operation which were used for passenger trains and transport of high value produce such as cotton bales, coffee and supplies.

Since the creation of ONAFITEX, a serious effort has been undertaken to find export markets for cotton seeds. The main handicap for exporting cotton seeds is the high transport cost from the ginneries to the export port of Matadi and the difficulty of finding maritime transport. A 1970 World Bank Study reported that cotton seed exports to Japan could be quite profitable if the price were in the neighborhood of 98 dollars per long ton C.A.F. Japan.

With the opening of a new ginning mill in Gemena and the improvement of transport conditions in Zaire and, in particular, rail transport in the Uélés, Zaire should be able to process all of its seeds. The demand for vegetable oil within Zaire and for export is strong, and since palm oil production in Zaire is decreasing, cotton seed oil could replace more and more palm oil for the production of margarine, vegetable oil and soap.

Summary

Historically a number of conventions with foreign controlled cotton ginning firms regulated cotton processing and marketing on a custom work basis. These conventions provided little incentive for operational efficiency and awarded generous profit margins to the ginners. By 1970 the reserves of COGERCO, the price stabilization fund and regulatory agency, were exhausted. In 1971 the government created a national cotton marketing office (ONAFITEX) in order to rationalize and improve the efficiency of the cotton marketing structure.

In 1970, half of the 115 ginning plants in Zaire were closed. Although sufficient ginning capacity is available, 30 new ginneries are now being installed by the government in Zaire. There is no economic justification for the purchase of these new mills.

Cotton marketing costs are very high. Transport costs represented one-fourth of total marketing costs, including the purchase of seed cotton in 1969. Transport costs were much higher for the Uélés than for Ubangi-Mongala. Transport costs are very high because of the poor state of the roads, the long distances involved in hauling seed cotton and the luxury goods rate charged by ONATRA and VICI-ZAIRE for the transport of cotton bales.

ONAFITEX reduced marketing costs by laying off expatriate personnel and through the reduction of transport rates, financing costs and baling costs. However, the collection of seed cotton in 1973 and 1974 started late and was extended over much of the year. This reduced the farmer's willingness to plant cotton, it occupied collection agents, many of whom are cotton extension workers, for a long time on collection, and it increased considerably transport costs.

The Zairean textile industry is well developed. A recently opened textile mill in Kisangani will considerably improve the marketing efficiency of cotton from the Uélés. The average sales prices of cotton fiber to domestic textile factories remained remarkably stable over the 1963-1973 decade. Presently, local fiber prices are kept low to protect the Zairean textile industry and Zairean consumers while export prices are high. The prospects for expansion of the domestic market are bright. Export opportunities are plentiful as Zairean cotton has an excellent reputation in export markets.

The cotton seed crushing industry is well developed but suffers from outmoded equipment and high transport costs. Since 1960 most mills have been operating in the red. In 1973 most cotton seeds in the North were either burned or dumped; a high capacity oil extraction mill is being opened in Gemena in Ubangi and will process all the seeds from Ubangi-Mongala and probably some from the Uélés.

CHAPTER V

THE ORGANIZATION OF A FARM BUSINESS SURVEY OF COTTON FARMERS IN NORTHERN ZAIRE

Purpose of the Survey

The original plan of this research was to conduct a study of a small number of selected cotton growing villages in Northern Zaire. The cost route method would be used to collect precise information on resource use and returns, especially with respect to labor, farm incomes and the relative profitability of different crops. Linear programming would be used to calculate the optimal enterprise combination on traditional farms and then compare the results with the present resource allocation to determine needed adjustments in the farm businesses. Although the Department of Agriculture thought such an approach was useful, they preferred that the study pursue a policy-oriented study of the entire northern cotton zone.[1] The Department believed that such a study would yield valuable insight on how to increase cotton production in the North as well as providing information on the future comparative advantage of cotton production in specific locations in northern Zaire.

Description of Survey Area

The Congo rebellion raged in the northern cotton zone from 1960-1967, particularly in the Uélés. The Presidency recently focused

[1]A study of all cotton growing regions in Zaire was not possible because of the size of the country, the wide dispersion of cotton growing areas and budget and time constraints.

attention on the North and announced that a serious effort would be made to industrialize and promote agricultural development in this area.[2] The North-East and North-West are well known for their agricultural potential. The Department of Agriculture is now devoting more attention to this area and is in the process of identifying and implementing agricultural development projects.

Little research has been devoted to the northern cotton belt although several pre-investment studies for a cotton project in this area have been done or are underway by FAO, World Bank and C.F.D.T.

The field survey area includes the Equator and Haut-Zaire regions with the Ubangi and Mongala sub-regions in Equator and the Bas-Uélé and Haut-Uélé sub-regions in Haut-Zaire. The Kibali-Ituri and Tshopo sub-regions in Haut-Zaire were not included in the survey as cotton production is marginal in these areas.[3]

The survey area is bordered on the west and north by the Ubangi river, separating Zaire from the Popular Republic of the Congo and the Central African Republic, and on the north and east by the border with Sudan and Uganda. The southern border corresponds to a straight line from Budjala in Ubangi to Wamba in Haut-Uélé. The distance east to west of this area is 800 miles while the distance from north to south is 220 miles.

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[2]The recent move of the Faculty of Agronomy from the capital city to Yangambi in the northern area is part of this effort by the Presidency to revitalize agriculture in the North.

[3]In 1970, according to the Annual Agricultural Report of the Haut-Zaire region, out of an estimated 41,051 ha. of cotton grown in Haut-Zaire, only 1,603 ha. were in Tshopo and 1,003 ha. in Kibali-Ituri [République Démocratique du Congo, 1970a]. In 1958, 105,470 ha. of cotton were reported for the Haut-Zaire region with 9,344 ha. in Tshopo and 3,291 ha. in Kibali-Ituri.

THe cotton belt is at the northern limit of the equatorial rain forest and includes equatorial rain forest and savannahs with the transition from rain forest to savannah: forest galleries along rivers, savannah woodland, tree savannah and shrub savannah.

Presently, there are no security problems but long distances, poor roads, dangerous bridges, unreliable ferries, poor communications and a lack of car repair facilities and board and lodging seriously handicap field research in this area.[4]

Survey Method

Several methods exist for collecting primary data on traditional farms in Africa [Collinson, 1972; Yang, 1965; Upton, 1973; Spencer, 1972]. The purposes of the survey, the available budget and the time constraint usually determine the choice of survey method. This researcher used the farm business survey and visited 160 cotton farmers twice, one visit during or after planting and one visit after the harvest. The 160 farmers were selected by a three stage sampling design. Since traditional farmers keep no written records, heavy reliance was placed on the farmer's recall. Thus, observational errors in this type of survey can be quite high [Spencer, 1972].

Determination of Sample Size

The main criteria used in the determination of sample size are budget and time considerations and the representativeness of the sample. A representative sample makes it possible to apply the results of the

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[4]The major roads between cities are in fairly good shape and adequate board and lodging can be found in the larger cities.

analysis to the population from which the sample was taken. However, although statistical theory helps us to determine the degree of representativeness of a sample, it is hard to apply this theory to a farm management survey in the African context.

The field research budget was only large enough to hire and equip four field enumerators for the entire northern cotton zone. It was estimated that enumerators would spend about half their time on travel and the other half on farmer interviewing, measuring fields and weighing cotton. Each enumerator was able to interview only 40 farmers during planting and harvesting periods. Hence,the sample size contained 160 farmers of an estimated 250,000 cotton farmers in the survey area which gives a sampling percentage of 0.064.

Selection of a Sampling Frame

The research budget and time constraints did not permit drawing a primary sampling frame of cotton farmers in the northern cotton belt. A list of farmers who were under "crop imposition"[5] and a list of farmers who had to pay a personal minimum tax[6] could have been utilized. However, in 1970 the Department of Agriculture with the aid of FAO organized an Agricultural Census in Zaire. All farmers who reported a cotton field in the 1970-1971 Census of Agriculture in the Ubangi,

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[5] All HAV's (homme adulte valide) or able-bodied adult males who are unemployed in a rural area are required to grow particular crops as prescribed by the regional authorities. Failure to comply may result in a prison term or payment of fines.

[6] The personal minimum tax for each HAV, called C.P.M. (contribution personnelle minimum) or minimum personal contribution is fixed at 2 Zaires per year, equivalent to 4 dollars. The tax list is usually prepared on the basis of the HAV list. The government agronomist in each zone, aided by the extension agents and the village chief, draw up the list of all HAVs.

Mongala, Bas-Uélé and Haut-Uélé sub-regions were listed by computer print-out. This list served as a frame for the farm business survey. Farmers with more than one field were listed more than once.[7] In total, 875 farmers were listed, 262 in Ubangi, 153 in Mongala, 282 in Bas-Uélé and 178 in Haut-Uélé.

A cross-check revealed that the 1970 Agricultural Census list contained the same errors as the crop imposition list (list of all HAVs) from which it was probably derived.[8] Some farmers were not included in the list, others appeared more than once but under different names, and still others could not be traced in the village. Since time was pressing to start the survey, we used the Agricultural Census frame and accepted its inaccuracy.[9] This frame offered the opportunity to gather information on the same cotton farms at two points in time, 1970-1971 and 1972-1973. Since the seed cotton price increased by 50 percent from 1971 to 1973 while food grain and staples' prices remained constant, the unique opportunity to study the price responsiveness of cotton farmers was presented.

A drawback of this frame was the possibility of ending up with less than 160 farmers as some may have migrated to other areas, died or simply stopped growing cotton. In fact, the survey yielded only 129 usable questionnaires (see Chapter VI). The frame is also biased

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[7]Less than 5 percent of cotton farmers had more than one cotton field.

[8]The frame for the 1970 Agricultural Census was also prepared under the responsibility of the government agronomist in each zone.

[9]Using an inaccurate frame introduces a bias in the survey. It was judged that the bias was acceptable taking into consideration the cost of drawing up a frame for this research.

against young cotton farmers or recent cotton growers as only farmers with a cotton field in 1970 were included in the frame.

Sampling Procedure

The 1970 Census of Agriculture included a complete survey of all agricultural holdings in the commercial sector and a sample survey of the traditional farms. The purpose of this survey was to gather reliable statistics on farming systems, land tenure and type of holding, land utilization, input use, crop acreages and yields, production, storage, sales and employment. The sample survey of the traditional sector included 16,800 holdings clustered in 446 areas.[10] There are an estimated 2,941,294 traditional farms in Zaire [République du Zaire, 1973b].

Each farm in the Agricultural Census was visited three times at selected intervals over the March 1, 1970 through March 1, 1971 period. The questionnaire used in the Census was guided by the 1970 FAO World Census of Agriculture, Regional Programme for Africa.

The farmers included in the sample survey were selected by a two-stage random sampling procedure. The country was stratified in eight regions and each region into two, three or four sub-regions following the administrative organization. In each region a complete list of "groupements" was drawn up, excluding urban areas and mining areas with little or no agricultural production.[11] These "groupements" are the

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[10] Information supplied by Mr. Jansonius, FAO, expert for the Census of Agriculture.

[11] A "groupement" is the smallest administrative unit in Zaire containing ten or more villages. In the Agricultural Census it is the primary sampling unit.

primary sampling units. In each region from 56 to 62 "groupements" were selected by weighted random sampling with probabilities proportional to the estimated number of holders per sub-region and per "groupement." The number of agricultural holders in each "groupement" was estimated on the basis of the total number of men and unmarried women listed in the latest population census. The number of "groupements" was determined by allotting two "groupements" for each of the enumerators in the region. On the average, there were 28 enumerators in each region. The "groupement" was split up in two or more primary units when the number of holders exceeded 800. For each selected primary unit the enumerator compiled a list of all agricultural holdings. He then drew 35 holdings in each "groupement" by systematic random sampling.

Sampling Plan

The cotton farmers for the field survey were selected by three-stage random sampling: two-stage random sampling in the Census of Agriculture which yielded the frame and one-stage random sampling from the frame. The farmers were selected by weighted random sampling with weights proportional to the 1970 seed cotton production in each sub-region (Table 5.1). For each sub-region the farmers were selected by random sampling.[12] The results of this sampling procedure are shown in Table 5.1. One hundred sixty cotton farmers were selected, dispersed in 109 different villages and clustered in 33 primary sampling units or "groupements."

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[12]Four farmers were selected twice because they appeared more than once in the 1970 agricultural census frame as they had more than one cotton field. However, the next farmer on the list was selected as a replacement for each of the four.

Table 5.1. Sampling Plan Used in the Farm Business Survey of 160 Cotton Farmers in Northern Zaire, 1972-1973

Sub-Region	Seed Cotton Production, in Tons[1]	Number of Cotton Farmers Selected	Number of Primary Sampling Units Selected	Number of Villages Selected
Ubangi	9,377	72	9	46
Mongala	1,640	13	5	12
Bas-Uélé	5,942	45	11	30
Haut-Uélé	4,024	30	8	21
Total	20,983	160	33	109

[1] République Démocratique du Congo, 1970a. Rapport Annuel, Service Provincial de l'Agriculture, Province du Haut-Zaire. Kinshasa: Ministère de l'Agriculture; République Démocratique du Congo, 1970b. Rapport Annuel, Service Provincial de l'Agriculture, Province de l'Equateur. Kinshasa: Ministère de l'Agriculture.

Selection, Training and Supervision of Field Enumerators

Field enumerators were not solicited from the Department of Agriculture because they were engaged in a major survey on coffee. Instead, this researcher looked for enumerators with an agricultural background and with some formal training in agriculture. The Higher Technical Agricultural School of Mondongo (E.T.S.A.-Mondongo, 20 km. west of Lisala) and the Higher Institute of Agricultural Education of Bengamisa (I.S.E.A.-Bengamisa, 60 km. north of Kisangani) provided us with the addresses of their recent graduates and drop-outs. Two Mondongo graduates were hired in Gemena. Both were from the region in which they were supposed to work. Then, three drop-outs from Bengamisa were asked to participate in enumerator training in Kisangani. Two were hired after they passed a theoretical exam and a field test. All four field enumerators had completed secondary school and had some agricultural training.

The enumerators were posted in Ubangi, in Ubangi plus Mongala, in Bas-Uélé and in Haut-Uélé. They were all fluent in French and Lingala. The enumerators for Ubangi and Mongala were also fluent in Ngwaka and the enumerators for the Uélés in Kiswahili.

Each enumerator was assigned specific farmers, on the average forty, the number depending mainly on the distances of travel required, his type of transport vehicle (bicycle or motorcycle) and his surveying skills. The field enumerators were paid a fixed monthly salary of 30 Zaires and a variable bonus of up to 10 Zaires per month, depending upon the quality of work during the month.

Two field enumerators were trained at Bwamanda, a Catholic mission 100 km. south-west of Gemena, and the other two at the O.N.R.D. office in Kisangani.[13] The office training which took about ten days emphasized the purpose and importance of the survey, the significance of each item in the questionnaire, methods of field measurement, techniques of approaching farmers and administrative procedures. These lectures were supplemented by on-the-job training in the field which included interviewing techniques, field size measurement, crop density counts, disease identification and bicycle or motorcycle repair and maintenance. Each enumerator was given a survey manual, in which the

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[13]At these training sessions assistance was provided in Bwamanda by Mokako Kuma E. Madjo, student in the Department of Agricultural Economics at the National University of Zaire in Kinshasa, and in Kisangani by Bazola Muangu, researcher at the National University of Zaire in Kisangani.

ontents of the course were summarized. Throughout his field work, he was instructed to record any problems which might occur in his survey manual.

Preliminary interviewing in the Bwamanda area served as pre-testing of the survey questionnaire and field survey methods. Some items in the questionnaire were found irrelevant and redundant and were deleted. Other questions were too sensitive and were dropped. Since the initial questionnaire required more than two hours of interviewing, the schedule was administered in two sections on different days.

Each enumerator was provided the essential materials and equipment needed for field research. Besides the questionnaires and a survey manual, he was given rubber boots, raincoat, bicycle or motorcycle with a repair kit and tools, a briefcase, travel bag and office supplies (writing materials, a writing pad, protractor, compass, envelopes and paper, postage stamps). He was also given drugs for malaria, diarrhea and a few other diseases. For the measuring of fields, he received a measuring chain or tape and a measuring wheel, a surveyor's compass and a 3m. by 3m. crop density square cord; he was given a spring balance to weigh cotton.

The author supervised the enumerators personally and visited them on unannounced days on an average of once a month. During the visit this researcher paid their salary, supplied the necessary survey materials, and attempted to solve other problems. Questionnaires were checked for errors and omissions or discrepancies were corrected on the spot by the enumerator. An effort was made to accompany each enumerator during some of the interviewing and measuring of fields.

This helped in getting to know how data was collected to make contact with farmers and local extension personnel; it was also good for morale of the field enumerators and farmers.

Locating Farmers

When arriving in a new survey village, the enumerator always contacted the local agricultural extension agents or agricultural officers who then introduced the enumerator to the farmers. This helped in locating the farmers and insured farmer cooperation. Often the extension agent assisted the enumerator with his survey work.

Questionnaire Design, Tabulation and Handling of the Data

The questionnaire was prepared in French and the questions were worded and listed exactly in the way that they should be asked. The enumerators then framed the questions in the vernacular language familiar to the respondents (Lingala, Ngwaka or Kiswahili). The questions were cross-checked to detect the accuracy of the information supplied by the farmers. Some items in the schedule turned out to be irrelevant such as questions on farm mechanization, fertilizer and pesticide use because none of these was used by the farmers. Questions on prices received for seed cotton were often misunderstood by the farmers as the concept of "price" was unfamiliar to many of them. For example, several understood "price" as the total amount of money received for their cotton crop. Questions on the farmer's possessions and on borrowing and lending behavior were found to be quite delicate and had to be handled with caution at the end of interviewing. Specific questions on personal possessions had to be deleted as they were too sensi

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sensitive. Finally, open-ended questions were included at the end of the questionnaire to determine beliefs, values and thought patterns affecting agriculture and cotton production.

The data in the questionnaires were summarized and hand tabulated on separate worksheets. Answers to quantative questions were tabulated to determine frequency distributions, averages, percentages and dispersions. Qualitative answers were grouped in classes, each class being a collection of similar answers. The classes were also tabulated and a frequency distribution was made. A large amount of time was required for this activity because of the comprehensive nature of the questionnaire.[14] The tabular method and regression analysis were then employed to study relationships between various farm management factors.

Summary

A farm business survey was conducted in northern Zaire over the 1972-1973 cotton production year. The farmers for the field survey were selected by three-stage random sampling. As frame, we used a list of all cotton farmers included in the 1970 Agricultural Census in northern Zaire. One hundred sixty cotton farmers were selected, dispersed in 109 different villages and clustered in 33 primary sampling units. Four field enumerators visited each farm twice a year, once before harvest and once after harvest.

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[14]Tollens [September 1974b] describes a method to eliminate most of the tabulation and computation work by using pre-coded survey forms which allow keypunching to be done directly from the form.

CHAPTER VI

ANALYSIS OF THE FARM BUSINESS SURVEY DATA

Characteristics of the Survey Sample

Nonresponse and Drop-Out

The original sample consisted of 160 respondents chosen from the frame of the 1970-1971 Agricultural Census in Zaire. However, only 129 respondents produced usable questionnaires. Nonresponse and drop-out occurred for the following reasons:

9 had gone to work for a company or a private person since 1971;

8 had moved to another rural area;

5 were sick and could not be interviewed;

3 had died since 1971;

2 had left for a city;

2 were too old and could not be interviewed;

1 was in prison; and

1 could not be located.

Forest and Savannah Areas

A farmer was classified as being in a forest area when his cotton fields were located in the forest. Often farmers have their fields in the forest although they live on a strip of savannah. Since much of the northern cotton belt is on the fringes of the dense rain forest, farmers often have the option of locating their fields in forests or in savannahs.

Of the 129 respondents, 102 or 79.1 percent located their cotton fields in the forest and 27 or 20.9 percent located them in savannahs, distributed as follows between the four sub-regions included in the survey:

	Ubangi	Mongala	Bas-Uélé	Haut-Uélé	Total North
Forest areas	56	7	30	9	102
Savannahs	11	3	1	12	27

Our sample included a relatively large number of cotton fields in forest areas and relatively few in savannahs. Hence, it was difficult to derive statistically valid inferences for savannah areas. It was thought that random sampling from the 1971 Agricultural Census frame would have yielded a random distribution of cotton fields in forests and in savannahs, but this did not occur. In retrospect the sampling should have been stratified according to ecological area, forest or savannah,because of the large differences in environmental conditions and farming systems between these areas.

Farmers in Paysannats

Seventeen respondents (13.2 percent), all from Ubangi, were located in a paysannat. Location in a paysannat should be considered a criteria for stratification because these farmers had been exposed to improved production technologies and intensive agricultural extension efforts in the past.

Farmers Possessing a Cotton Farm Book

Eighty out of 129 farmers (62.0 percent) possessed a cotton farm book, a small book which each cotton farmer used to receive from COGERCO or ONAFITEX in which the amount of cotton seed received and the sales of seed cotton per grade were registered by the cotton extension or cotton collection agent. Payments in kind (salt, small farm tools, etc.) were also recorded in this book, which proved to be a valuable source of information for this study.

Farmers in the Congo Rebellion

The Congo rebellion swept over the eastern part of the northern cotton belt from 1961 to 1965. As a result of the hostilities, many farmers fled their villages and hid in the bush. Sixty-one out of 129 farmers interviewed in the survey experienced rebellion activities in their villages and 49 abandoned cotton production during these difficult years.

Characteristics of Cotton Farmers[1]

General Characteristics

The Ngbaka and Zande make up over 50 percent of the farmers. In total, the farmers belong to 13 different ethnic groups. About 70 percent of the farmers indicated that they were Catholic. The remainder were Protestant, Kimbangist or had no religion.[2] The average age of the respondents was 44 years. For Ubangi and Mongala, it was 41 years; for

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[1]As there were only ten farmers from Mongala included in the survey, usually no separate results will be presented for this sub-region. They will be added to those of Ubangi.

[2]Kimbanguism is a prophetic and messianic movement which was started in 1921 in Lower Congo province by Simon Kimbangu and which developed into a religion recognized by the state.

Bas-Uélé, 47 years and for Haut-Uélé, 48 years.[3] The survey questions were addressed to the household head who is usually the head of the family. The average age seems high, but one should bear in mind that the head of the family is usually the oldest person in the family.

On the average, 91.5 percent of the farmers derived their income exclusively from agriculture, including hunting and fishing. The figures per sub-region are 92.2 percent for Ubangi and Mongala, 93.5 percent for Bas-Uélé and 85.7 percent for Haut-Uélé. The most important secondary activities were maintaining a small shop for the sale of consumer goods and being a part-time counselor or judge in the village administration.

Most farmers interviewed in the survey were illiterate. On the average, they had received 1.4 years of formal schooling; 57.0 percent of the farmers never went to school. Those who went to school spent on the average 3.1 years in school. Detailed data are presented in Table 6.1.

Of the farmers in the survey, 19.4 percent had resided in a city in the past. Residence in a city was defined as having established one's residence in a city for at least one month. A city was defined as each urban center considered a "city" by the farmer. Of the 129 farmers, 110 lived in the villages in which they were born.

Those farmers who had not yet resided in a city were asked why they had not moved to a city. Their responses are given in Table 6.2. Most farmers preferred to stay with their families in the villages and

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[3]There is the question about the extent to which farmers know their age. In Zaire each adult person has a national I.D. card. When the date of birth was not indicated on the citizen's card, the enumerator could usually derive his approximate age by recalling historical events to the farmer.

mentioned that they had no families in a city. Only one of the 129 farmers in this sample wanted to move to a city.

Table 6.1. Educational Characteristics of Cotton Farmers in Northern Zaire, 1972-1973

Sub-Region	Average No. Years in School	Percentage Who Went to School	Average No. Years in School for Those Who Went to School
Ubangi and Mongala	1.6	50.6	3.1
Bas-Uélé	1.0	29.0	3.4
Haut-Uélé	1.1	38.1	3.0
Average for the North	1.4	43.0	3.1

Table 6.2. Northern Zaire: Reasons Mentioned for not Moving to a City, per Sub-Region (in Percent)

Reasons Mentioned	Ubangi and Mongala	Bas-Uélé	Haut-Uélé	Average for the North
I could not find work in the city.	14.9	3.8	0.0	9.0
Life is too expensive in the city.	17.0	23.1	6.3	16.9
I prefer to stay with my family in the village.	51.1	57.7	56.2	53.9
I prefer to stay in agriculture	17.0	15.4	37.5	20.2
Total Percent	100.0	100.0	100.0	100.0

Employment History

Farmers were asked whether they had been employed outside their farms since 1960 and had been paid in money or in kind, above food and lodging, and for at least one month; 41.4 percent reported that they had been employed in some way in the past (51.3 percent in Ubangi and Mongala, 16.1 percent in Bas-Uélé and 42.9 percent in Haut-Uélé). Thus, many farmers have had some employment experience in the past.

Family Composition

On the average, each family was composed of 5.05 persons, and each farmer had 1.16 wives and 3.04 children. The age distribution per sub-region is given in Table 6.3. Average family size in Ubangi-Mongala was much larger than that in the Uélés with a higher degree of polygamy and a larger number of children per family.

The demographic pyramid in the Uélés is quite different from Ubangi-Mongala; the Uélés pyramid has relatively more people in the higher age brackets and, apparently, a much lower fertility rate. This confirms the findings of the 1970 demographic survey in Zaire which indicated a precarious demographic situation in the Uélés (see Chapter III).

The survey found on the average one person living with the family who did not belong to the family by birth (ascendents, descendents) or marriage. However, these persons usually have ties with the family in that they are, fiancés, orphans, cousins, etc. In a broad sense, then, they could be counted as part of the family.

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Table 6.3. Average Family Composition on Cotton Farms in Northern Zaire, 1972-1973

Age	Ubangi and Mongala	Bas-Uélé	Haut-Uélé	Total North
Under 15 years	2.71	1.19	0.62	2.01
16-64 years	2.99	2.39	2.38	2.74
Over 65 years	0.45	0.03	0.14	0.30
Total	6.15	3.61	3.14	5.05
Number of wives	1.25	1.00	1.10	1.16
Number of children	3.66	2.65	1.33	3.04
Other Persons Living with the Family				
Under 15 years	0.36	0.26	0.00	0.27
16-64 years	0.70	0.68	0.52	0.67
Over 65 years	0.05	0.00	0.14	0.05
Total	1.11	0.94	0.66	0.99

Food Consumption Habits

Farmers were asked to enumerate and rank, according to their importance in the diet, the principal food products which they consume. In Table 6.4 the percentage of farmers who ranked a food product in 1st, 2nd, 3rd, etc. class is given. The 4th, 5th and 6th class are of lesser importance and are less accurate as not all farmers could rank beyond the 3rd class.

Maize flour, manioc (roots and leaves) and bananas are the principal food staples with maize and manioc the most important food product in the North-West and manioc and bananas the principal food products in the North-East. Rice, groundnuts, yams, sweet potatotes, vegetables, meat and fish are of lesser importance.

Land Tenure System in the North

Land Occupation Rights

All sample farmers operated their farms for their own account. One farmer considered himself an "independent farmer."[4] In addition, all farmers except four held land under the customary land tenure system.[5] The nature of the indigenous land tenure systems varies widely among the different groups of people. According to Harms [June 1974], the corporate group that holds the land is usually a small group--a lineage which may be a village or part of a village or, in some cases, a political chiefdom. Generally, the man responsible for land is relatively low in the political hierarchy. Furthermore, the land held by the group has fixed boundaries which are either clearly marked by geographical features or not marked at all. There are several kinds of rights in land, such as hunting rights, gathering rights and cultivation rights. All the members of the corporate group generally hold hunting and gathering rights in the uncultivated areas of the group's land, whereas plots under cultivation belong to the individual cultivators or their immediate families. The individual cultivator gains rights to a plot

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[4]"Independent farmers", called "Planteurs indépendants," are farmers who are not subject to crop imposition. Usually, these farmers are the most progressive in their region and are fairly well integrated in the economic system as they produce primarily for sale. They almost always operate a coffee plantation. They also pay more than the minimum head tax (C.P.M.). Sometimes they possess an identification card delivered by the local government agronomist with their status of "independent farmer" being marked on the card.

[5]In Ubangi-Mongala one farmer, a village head, held land in private ownership. Another farmer stated that he held land in concession from a village chief. Two other farmers rented land from somebody else against payment of a small fee.

Table 6.4. Ranking of Principal Food Products Consumed by Cotton Farmers in Percentages of the Responses per Rank, Northern Zaire, 1972-1975.

Food Products	1st Rank	2nd Rank	3rd Rank	4th Rank	5th Rank	6th Rank
Maize flour	41.2	13.4	2.5	---	3.0	---
Manioc leaves	22.1	21.2	9.2	19.6	4.5	8.3
Manioc flour	21.4	29.8	26.2	14.9	10.4	4.2
Bananas	12.2	20.5	37.9	12.6	9.0	---
Groundnuts	1.5	2.4	---	5.7	7.5	8.3
Vegetables	1.6	---	0.8	---	14.9	8.3
Meat	---	0.8	---	4.6	14.9	29.1
Fish	---	2.4	3.4	9.2	14.9	18.8
Palm wine	---	0.8	0.8	---	1.5	4.2
Rice	---	8.7	10.9	12.6	3.0	2.1
Sweet potatoes	---	---	2.5	3.4	13.4	4.2
Yams	---	---	3.4	3.4	1.5	10.4
Other	---	---	2.4	4.8	1.5	2.1

of land by putting it under cultivation and maintains his rights until he abandons the field.

Farmers had mixed feelings about cultivating land of other groups even when they were authorized to do so. In Ubangi-Mongala about 80 percent indicated that they would cultivate land belonging to other clans as compared with less than 20 percent in the Uélés. This is probably related to population densities which are much higher in Ubangi-Mongala than in the Uélés.

Renting of Land and Land Utilization Charges

None of the farmers included in the survey leased their land, although two farmers were renting land. Farmers holding cultivation rights to land do not have to pay anything in cash or kind to those with authority over land. However, most farmers occasionally do have to work for the head of the village or head of the clan which may or may not be related to securing cultivation rights for land.

Selection of New Fields

Farmers were asked who selected new fields to be brought into cultivation. Only 20.4 percent of the farmers picked a new field by their own choice. However, this question is somewhat vague and lacks precision, for there are three distinct elements involved in the choice of a new field: location, size of the field and, associated with these, choice of crop rotation. Data in Table 6.5 points up the importance of the agricultural monitors and extension agents in the choice of a new field.

Table 6.5. Responses to Question: "Who Selects New Fields to be Brought Into Cultivation?", Northern Zaire, 1972-1973

Who Selects New Fields	Ubangi and Mongala	Bas-Uélé	Haut-Uélé	Total North
Agricultural Monitors[1]	59.0	64.7	76.0	63.5
Farmers themselves	29.5	14.7	0.0	20.4
Village or Clan Authorities	3.8	20.6	0.0	11.7
Territorial Agronomist	7.7	0.0	24.0	4.4
Total Percent	100.0	100.0	100.0	100.0

[1]Agricultural monitors (moniteurs agricoles) are agricultural extension agents.

Communal Crops and Fields

Communal crops or fields are defined as crops grown on a field for which all labor inputs are communal and all field proceeds are distributed among the members of the group. In Ubangi and Mongala 22.1 percent of the farmers had communal crops or fields. They were all small coffee plantations. About one-fourth (23.8 percent) of the farmers would agree to join a communal field. Those who refused gave as the principal reason the difficulties in distributing the proceeds from the field (Table 6.6). Thus, farmers were not in favor of communal crops or fields.

Table 6.6. Reasons for not Participating in a Collective Field, Northern Zaire, 1972-1973

Reasons	Ubangi and Mongala	Bas-Uélé	Haut-Uélé	Total North
Difficulties in distributing the proceeds	62.5	81.0	46.2	64.6
Others won't work hard	31.3	19.0	46.2	30.5
Cannot trust the others	6.2	0.0	7.6	4.9
Total Percent	100.0	100.0	100.0	100.0

Crop Imposition

In 1972-1973 we found that on the average, 86.0 percent of the sample farmers in the North were under obligation to grow cotton: 83.1 percent in Ubangi-Mongala, 83.9 percent in Bas-Uélé and 100.0 percent in Haut-Uélé. The average acreage imposed was 47.0 ares in Ubangi-Mongala, 47.8 ares in Bas-Uélé and 49.7 ares in Haut-Uélé. However, only 52.7 percent of the farmers knew the acreage imposed. Regional decrees signed by the regional commissioner provide the legal framework for required cultivation.[6] Execution is up to the local authorities, mainly the territorial agronomist and agricultural monitors (see Table 6.7). Usually, the territorial agronomist commands the agricultural monitors and the authorities of the local collectivity. Those generally exempted from cotton growing were people with a paid job, independent farmers, single persons, widows and people who were ill or old. Ignoring the cotton growing requirements leads to stiff fines and/or jail terms enforced by the local police force. All the farmers interviewed were well aware of the consequences of not growing cotton. The fines ranged from 0.50Z to 5.00Z, with a modal value of 3.50Z. These fines may be combined with jail terms ranging from one week to 60 days, with a mode of 25 days. It is up to the local law enforcement units to determine the exact punishment to be applied. Enforcement is usually carried out shortly after the usual planting time of cotton.

The size of the imposition of the cotton field is usually dependent on the family situation of the farmer. Single farmers need only to plant a small field, while married farmers with more than one wife are required to grow a large field, up to one hectare in Haut-Uélé.

According to Zaire Magazine of November 4, 1974 [Nr. 326], the Agricultural Commission of Haut-Zaire region recommended a reinforcement of "educative crops" in order to stimulate cotton production. On the average, 30.2 percent of the cotton farmers were also required to grow other crops such as coffee, rice, maize, manioc and groundnuts.

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[6] Formerly the governor of a province.

Table 6.7. Responses to Question: "Who Imposes Cotton Cultivation?", Northern Zaire, 1972-1973

Who Imposes	Ubangi and Mongala	Bas-Uélé	Haut-Uélé	Total North
Territorial agronomist	72.6	3.8	76.2	36.7
Agricultural monitors	24.2	96.2	0.0	56.9
Authorities of the local collectivity	3.2	0.0	23.8	6.4
Total Percent	100.0	100.0	100.0	100.0

Labor Utilization

Types and Units of Labor Used on Cotton Farms

The majority of labor used on cotton farms in northern Zaire was family labor. On the average, 3.89 units of labor were available per farm (Table 6.8). All outside labor hired on cotton farms was day-labor, and day-laborers were only engaged on farms in the forest areas, except for one farm. Day-laborers were only hired for the task of felling trees and clearing the forest. For the North, cotton farmers hired on the average 0.43 day-laborers who worked, on the average, 3.24 days on the farm on which they were engaged. The average wage paid was 15.9K per day (15.6 K in Ubangi-Mongala and 20.0K in Bas-Uélé). They always received food and drink during their work.

Labor in mutual exchange or communal labor is fairly common in Zaire. On the average 6.05 persons participated in the mutual exchange of labor for an average duration of 3.1 days per person.

Table 6.8. Types of Labor Used on Cotton Farms in Northern Zaire in Percentages and Units of Family Labor Available, 1972-1973

Types of Labor	Ubangi and Mongala	Bas-Uélé	Haut-Uélé	Total North
Only family labor	79.1	90.0	100.0	85.5
Predominantly family labor	17.9	10.0	0.0	12.8
Predominantly hired labor	3.0	0.0	0.0	1.7
Units of Family Labor Available[1]	4.57	3.00	2.76	3.89

[1]A labor unit is a unit-measure of labor capacity in a family and is defined as equal to 1.0 for adults between the ages of 16 and 64 years and 0.5 for those under or equal to 15 years or above or equal to 65 years.

Man-Weeks of Labor Input in Cotton Production

In Table 6.9 the labor inputs for cotton production in man-weeks per hectare are presented. A man-week is defined as five days of labor performed by an adult male or female. Saturdays are usually reserved for self-help activities on roads, schools, etc., Sundays are for rest, although most village markets operate on Sundays. The data are rough estimates as they were based on only two visits per farm in the survey, one before and one after cotton harvest. It is impossible to collect accurate labor figures for a crop with only two visits per farm.[7]

The data in Table 6.9 are to be considered upper limits. When a farmer declares that he and his family worked for three weeks weeding a cotton field, it is understood that he also carried out his regular

[7]Collinson, however, argues that limited visit surveys are adequate for the collection of labor data for planning purposes when the farming system is relatively simple. More on this point is found in Collinson [1972], Collinson [December 1974] and Spencer [1972].

Table 6.9. Labor Input in Man-Weeks for One Hectare of Cotton, Northern Zaire, 1972-1973

Sub-Regions	Land Preparation	Planting Seeds	Maintenance	Harvest and Sorting	Total
Ubangi and Mongala	5.0	4.5	18.7	34.5	62.7
Bas-Uélé	20.0	12.3	22.6	49.4	104.5
Haut-Uélé	23.9	18.7	36.3	69.7	148.6
Total North	10.9	8.1	21.6	42.0	82.6

subsistence activities such as tapping palm wine, hunting, fishing, harvesting food for home consumption, maintaining his food crop fields, repairing his house, visiting friends and neighbors, etc. The smaller the cotton field, the larger the effect of overestimation is likely to be as farmers are less occupied on small fields compared to large ones, other things being equal. It does appear from Table 6.9 that the smaller the cotton fields, the higher the labor inputs per hectare. Since the labor figures were converted to a per hectare basis, this may help to explain the seemingly excessive labor inputs for farms in Haut-Uélé where field sizes are the smallest, an average 0.25 hectares compared to 0.40 hectares in Ubangi-Mongala.[8]

We will not utilize the data from Table 6.9 for the calculation of returns to labor nor for the relative profitability of different crops.

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[8]Labor data were only derived for 19 farms in Haut-Uélé compared to 67 farms in Ubangi-Mongala.

Arduousness of Labor and Labor Bottlenecks on Cotton Farms

Farmers were asked when they were the busiest not only because of cotton but also as a result of work for other crops grown on the farm. The purpose of this question was to collect information on labor bottlenecks and peak seasonal labor demands. The results are presented in Table 6.10.

Table 6.10. Period of the Year in Which Farmers were the Busiest, Northern Zaire, 1972-1973

Months	Ubangi and Mongala	Bas-Uélé	Haut-Uélé	Total North
December, January, February	80.6	30.0	36.8	60.3
July, August, September	19.4	70.0	63.2	39.7
Total Percent	100.0	100.0	100.0	100.0

The question was not well understood by the respondents. Several farmers equated "most" labor with "arduous" labor or answered that they were busy all year round. Unquestionably, although felling trees and clearing land in the savannah areas are arduous tasks which are performed by men, it is not necessarily the busiest time. Since most respondents were men, the answers were probably biased towards tasks performed by men.

Felling trees and clearing land are done from mid-November to the end of February during the dry season, coinciding with the cotton and coffee harvesting season. Typically, harvesting and sorting of cotton is done by women and children who are occasionally aided by men. The majority of the farmers in Ubangi and Mongala indicated that this was the busiest season. In the Uélé's July, August and September were believed to be the months with most work, followed closely by December, January and February.

In June and July cotton seeds are planted during the short dry season. Crop maintenance, especially thinning and weeding during the first two months after planting, is critical and is believed to explain a large part of the variation in yields. When thinning and weeding start too late, the fields rapidly become overgrown with weeds, and yields drop considerably. Moreover, weeding in cotton fields coincides with weeding of food crops (maize, manioc, rice, groundnuts, etc.) and coffee. Although farmers consider harvesting and sorting of cotton and clearing of new fields in December, January and February as their most difficult tasks, the most critical activity affecting cotton yields is undoubtedly thinning and weeding of cotton fields in July, August and September.

Of the farmers questioned, 58.8 percent indicated that they could grow more cotton with the labor available on their farm. Farmers gave the following reasons why they did not produce more cotton: low cotton prices, old age and poor health were the most frequent answers.

Road Maintenance

Farmers are required to help repair the roads which pass through their villages. On the average, 83.7 percent of the farmers had to perform this service for an average duration of 6.7 weeks per year. The authorities who order farmers to work on the roads are predominantly from the local collectivity or from the village or clan (Table 6.11). Work on roads often conflicts with activities in cotton fields; 88.1

percent of the farmers responded that road work interfered with their cotton operations.

Work Performed by Farmers for the Head of the Village or Clan

Some cotton farmers also had to work for the chief of the village or the head of the clan; 41.4 percent of the farmers had performed duties for these authorities during the past year for an average 10.5 weeks. These duties consisted of working on the fields of the chief, repairing his house, etc. Again, over three-fourths of the farmers declared that these duties interfered with their cotton schedule.

Table 6.11. Authorities Requiring Farmers to Work on the Roads, Northern Zaire, 1972-1973

Authorities	Ubangi and Mongala	Bas-Uélé	Haut-Uélé	Total North
Local Collectivity Authorities	60.3	46.7	41.7	53.3
Village or Clan Authorities	26.5	53.3	50.0	37.7
Territorial Agronomist	10.3	0.0	0.0	5.7
Territorial Commissioner	2.9	0.0	8.3	3.3
Total Percent	100.0	100.0	100.0	100.0

Off-Farm Paid Labor and Legal Minimum Wages

Only six farmers out of the 129 respondents were employed outside their farms for part of the year during the survey. These farmers received an average of 17.2K per day plus food and drink. They held a variety of jobs: mason, judge, night guard, coffee sorter and day-laborer for felling trees.

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Table 6.12. Average Number of Tools and Equipment Found on Cotton Farms, Northern Zaire, 1972-1973

Tools and Equipment	Ubangi and Mongala	Bas-Uélé	Haut-Uélé	Total North	Percentage of Farmers Having Tool	Average No. For Farmers Having Tool
Machete	2.86	1.94	2.38	2.56	100.0	2.56
Hoe	2.08	2.03	2.57	2.15	100.0	2.15
Axe or Hatchet	1.10	1.58	1.62	1.31	81.4	1.60
Spade	1.01	0.71	0.19	0.81	48.1	1.68
Coupe Coupe[1]	1.29	0.36	0.48	0.93	55.0	1.69
Basket	1.68	3.36	3.86	2.43	62.8	3.88

[1]A long knife bent at the end for cutting grass.

Farm Tools and Equipment

No machinery operated with a motor was utilized on cotton farms included in the survey.[9] As in most of Zaire, animal traction does not exist in the North. Most farmers possessed only a small number of tools and equipment. The average number of tools and equipment found on cotton farms is given in Table 6.12. The machete, hoe and axe were present on nealy all farms. Weeding is often done by hand or with the machete instead of the hoe. Most of the equipment is fairly old and part of it had been received from the Government, COGERCO of ONAFITEX. Farmers paid on the average 18.9K per year for repairing tools and equipment. Of the farmers responding, 45.7 percent knew a blacksmith in their village. Farmers had difficulties in buying new tools and equipment not produced by local blacksmiths. Several farmers complained about the high prices of new equipment

[9]Except Platz sprayers powered by a two stroke engine used by ONAFITEX for spraying or dusting pesticides on some cotton fields.

and the absence of improved tools in local shops. Obviously, ONAFITEX could play a useful role in this respect. Farmers were asked what tools and equipment they lacked most in order to improve their cotton production. Their responses are summarized in Table 6.13.

Table 6.13. Percentage of Cotton Farmers Lacking Tools and Equipment in Order to Improve Cotton Production, Northern Zaire, 1972-1973

Tools and Equipment	Ubangi and Mongala	Bas-Uélé	Haut-Uélé	Total North
Machete	80.5	80.0	71.4	79.1
Hoe	68.8	64.5	81.0	69.8
Axe	58.4	77.4	47.6	61.2
Spade	72.2	29.0	23.8	54.3
Coupe Coupe	32.5	6.5	33.3	26.4
Whetstone	23.4	9.7	0.0	16.3
Rake	16.9	9.7	0.0	12.4
Hammer	10.4	12.9	0.0	9.3
Long-Handled Hoe	11.7	0.0	0.0	7.0
Pickaxe	6.5	3.2	0.0	4.7

Fertilizer and Pesticide Use

No farmer in my sample had ever applied chemical fertilizers on his cotton farm. Moreover, they were generally unaware of chemical fertilizers. Chemical fertilizers are available in Zaire only in the major towns and are used in coffee and oil palm plantations.

Farmers are more familiar with pesticides and, in fact, confuse pesticides with chemical fertilizers. They call them both "Nkisi" or "drug" to make the cotton plants healthier. When the enumerators explained the use and effect of chemical fertilizers and pesticides to farmers, most expressed an interest in securing these products.

Eighteen percent of the farmers recalled that COTONCO had applied pesticides on their cotton fields before independence. A total of 10.5 percent of the farmers in Ubangi-Mongala reported that their cotton field(s) had been treated with pesticides by ONAFITEX, without charge, during the 1972-1973 campaign. Many farmers complained that only the fields along the roads were treated. Several agricultural monitors also remarked that the treatment came too late in the season to be effective.

Of the farmers questioned, 19.4 percent recalled that someone had explained to them how to use and how they could benefit from pesticides. In summary, cotton farmers in the North know very little about chemical fertilizers and pesticides.

Cotton Seed

Delivery of Cotton Seed

Agents of ONAFITEX and agricultural monitors are responsible for the distribution of cotton seeds to farmers. The seed is usually stored in a sack, suspended from the ceiling of the cotton storage shed. On the average, farmers received cotton seed in 1972 during the first week of May. Some farmers received seeds in March while others had to wait until June or even July.

A total of 12.9 percent of the farmers complained that they had received the seeds too late, on the average 4.8 weeks too late. Only 3.9 percent of the farmers knew the seed variety they had received.

Planting of Cotton Seed

No precise data could be gathered on the date of planting since farmers had difficulty in recalling the day or week of planting. Some fields were planted by the end of June, most were planted in July and the rest in early August. Generally, however, fields were planted one to three weeks too late for obtaining maximum yields. According to the C.F.D.T. Mission in Ubangi-Mongala, every day after optimal planting time reduces seed cotton yields by 5 kg. per ha. In addition, late planted cotton is more vulnerable to insect attacks, particularly dysdercus, at the end of the growth cycle during the dry season.

Farmers usually had a surplus of seeds left after planting.[10] Farmers put in, on the average, 5.4 seeds per pocket.

Crop Rotations and Duration of Fallow

Most farmers followed the recommended crop rotations in their region. In forest areas cotton is grown as the second crop in the rotation after a food crop, usually maize but sometimes groundnuts, while in savannahs cotton is planted as the first crop in the rotation. The basic crop rotation patterns found in the North are:

Forest Areas

Main Crops	Growing Season	Variations
Maize	March-June	or groundnuts
Cotton	July-December	
Groundnuts	March-June	or maize or manioc
Manioc (and bananas)	July-. . .	sometimes rice between groundnuts and manioc

In areas where rice is an important crop, the rotation is often as follows:

[10] Some farmers burned the surplus seeds on their fields to drive away insects and monkeys.

Main Crops	Growing Season
Rice	June-December
Groundnuts or maize	March-June
Cotton	July-December
Manioc (and bananas)	February-. . .
Fallow	

Savannah Areas

Main Crops	Growing Season	Variations
Cotton	June-December	
Groundnuts	March-June	or maize
Manioc (and bananas)	July-. . .	
Fallow		

Cotton is almost never grown in a pure stand but always mixed with other crops, such as manioc, vegetables, oil palm, papaya, pineapples, gourds, sesame, maize, groundnuts, sugar cane, bananas, tabac, etc. Still 8.4 percent of the farmers have practiced the same rotation year after year since the days of the colonial administration or since they began cultivating their own fields.

The average fallow time was 6.5 years which is far below the recommended time of 10 to 20 years. The relatively short fallow time is a factor which helps to explain the decline in yields since 1960, particularly since cotton cultivation rapidly depletes the soil of its nutrients. Farmers in forest areas return to the same field much more frequently than they do in savannahs.

The Cotton Field

The Location of Cotton Fields

Cotton fields were located on the average 1.9 km. from the home of the farmer. The main reason for such remoteness of many cotton fields seems twofold: a search for the most fertile soils and an attempt to discourage agricultural monitors and authorities from visiting the field.

Twenty-eight percent of the cotton fields in Ubangi-Mongala were grouped in one large bloc in the village, 0.0 percent in Bas-Uélé and 15.0 percent in Haut-Uélé. Such grouping greatly facilitates treatment with pesticides and visiting by agricultural monitors.

It was predominantly agricultural monitors and village or clan authorities who decided where the cotton field should be located. In fact, only about one-third of the farmers determined the location of their own cotton fields (Table 6.14).

Table 6.14. Persons Who Determine the Location of Cotton Fields, Northern Zaire, 1972-1973

Who Determines	Ubangi and Mongala	Bas-Uélé	Haut-Uélé	Total
Village or Clan Authorities	44.4	12.9	16.7	32.4
Farmers Themselves	30.9	41.9	20.8	31.6
Agricultural Monitors	16.1	45.2	54.2	29.4
Territorial Agronomist	8.6	0.0	8.3	6.6
Total Percentage	100.0	100.0	100.0	100.0

Number and Size of Cotton Fields

Farmers could obtain as much land as desired for cultivation, and no farmer reported any difficulty in getting as much land as he wanted. The size of cotton fields was predominantly determined by agricultural monitors and, to a lesser degree, by the territorial agronomist and village or clan authorities. Farmers themselves determined the size of their own cotton fields only in one case out of every ten as illustrated in Table 6.15.

The total number of cotton and other fields included in the survey and the average number of fields per farm are presented in Table 6.6. Only 7.9 percent of the cotton fields were recognized as pure stands by the enumerators. In Bas-Uélé most farmers had only one field, the

Table 6.15. Persons Who Determine the Size of Cotton Fields, Northern Zaire, 1972-1973

Who Determines	Ubangi and Mongala	Bas-Uélé	Haut-Uélé	Total
Agricultural Monitors	72.2	87.1	85.7	77.9
Farmers Themselves	11.4	12.9	0.0	9.9
Territorial Agronomist	13.9	0.0	4.8	9.2
Village or Clan Authorities	2.5	0.0	9.5	3.0
Total Percentage	100.0	100.0	100.0	100.0

Table 6.16. Total Number of Fields in the Survey and Average Number of Fields Per Farm, Northern Zaire, 1972-1973

Sub-Regions	Number Cotton Fields in Pure Stand	Number Cotton Fields with Inter-cropping	Number Other Fields	Total Number of Fields	Average Number of Fields Per Farm	Average Number of Cotton Fields Per Farm
Ubangi and Mongala	4	71	97	172	2.5	1.1
Bas-Uélé	1	31	2	34	1.1	1.0
Haut-Uélé	5	15	26	46	2.3	1.0
Total North	10	117	125	252	2.1	1.1

cotton field. Thus, in order to provide their family with food, they had to mix food crops with cotton, although this practice is discouraged by cotton extension workers. In other sub-regions farmers usually had at least one field with food crops in addition to the cotton field.

Average field size, average cotton acreage per farm and the acreage in other crops are given in Table 6.17. The largest fields and the largest number of fields per farm were in Ubangi and Mongala. There were, on the average, more than 50 percent more labor units available on these farms than in the Uélés (see Table 6.8). The average cotton acreage per farm was small, 35.7 ares less than one acre (40.5 ares). There was a large variation in cotton field sizes between farms, as evidenced by the large standard deviations.

The average cotton acreage per farm was larger in savannahs than in forest areas (Table 6.18). The difference was more pronounced in Ubangi and Mongala than in the Uélés and was probably related to difficulties of land clearing in forests.

A comparison between the 1970-1971 cotton acreage data per farm from the Census of Agriculture in Zaire and from the 1972-1973 farm business survey for the same farms is given in Table 6.19. The data are quite similar, except that cotton acreages per farm were much larger in Bas-Uélé in 1970-1971 than in 1972-1973. Cotton acreages per farm were also larger in forest areas than in savannahs, the opposite of the 1972-1973 data.

Termite Hills

There were termite hills in 33.6 percent of the cotton fields, on the average 2.2 hills per field. The termite hills, mostly fossil

Table 6.17. Average Size of Fields, Average Acreage per Farm and Average Total Farm Size, Northern Zaire, 1972-1973 (in Ares)[1]

Sub-Regions	Average Size Cotton Fields	Average Size Other Fields	Average Cotton Acreage Per Farm	Average Acreage Other Crops Per Farm	Average Total Farm Size
Ubangi and Mongala	35.1 (20)	52.8(108)	40.0(20)	73.6(144)	113.6(160)
Bas-Uélé	32.1 (21)	15.8(8)	33.2(21)	1.1(4)	34.3(27)
Haut-Uélé	25.1 (19)	23.7(17)	25.1(19)	28.6(20)	53.7(30)
Total North	32.8 (21)	46.5(96)	35.7(21)	47.3(111)	83.0(126)

[1]The figures between brackets are the standard deviations.

Table 6.18. Average Cotton Acreage Per Farm in Forests and in Savannahs, Northern Zaire, 1972-1973 (in Ares)

Sub-Regions	Forest Zones	Savannah Zones
Ubangi and Mongala	38.6	47.2
Bas-Uélé and Haut-Uélé	29.5	31.7
Total North	35.0	38.4

Table 6.19. Average Cotton Acreage per Farm for 1970-1971 (Census of Agriculture Data) and for 1972-1973 (Farm Business Survey Data), Northern Zaire (in Ares)[1]

Sub-Regions	1970-1971	1972-1973
Ubangi-Mongala	41.3 (18)	40.0 (20)
Bas-Uélé	49.4 (31)	33.2 (21)
Haut-Uélé	22.7 (17)	25.1 (19)
Total North	40.1 (24)	35.7 (21)
Forest Areas	40.8 (23)	35.0 (25)
Savannahs	37.8 (27)	38.4 (25)

[1]Data for the 1970-1971 Census of Agriculture in Zaire is derived from a preliminary computer print-out of the results of the Census; the figures between brackets are the standard deviations.

and sometimes up to 4 or 5 meters high, are not cultivated as most of the soil in the hills is sterile. The hills were also serious obstacles in measuring field sizes, and will hamper mechanization.

Plant Densities

Cotton plant densities on cotton fields in northern Zaire were fairly uniform as illustrated in Table 6.20. Some farmers used a knotted rope to determine the spacing between plants and between rows. The average distance between rows was less than the recommended one (80 cm.) in the Uélés. The average distance between plants in the row in all sub-regions was much greater than the recommended distance (30 cm.) particularly in the Uélés.[11]

[11]A spacing of 80 cm. x 30 cm. gives theoretically 41,625 pockets per ha. With two plants per pocket, this is 83,250 plants per ha.

The C.F.D.T. Mission in Ubangi-Mongala recommends a minimum density of 40,000 pockets per hectare and thinning to two plants per pocket. Higher densities did not increase yields. Below this density, yields in kg. per ha. decreased. Thus the plant densities observed in cotton fields in the northern belt were well below the recommended density.

Table 6.20. Cotton Plant Density and Spacing Between Cotton Plants, Northern Zaire, 1972-1973

Sub-Regions	Number of Plants per Hectare[1]	Distances in cm. Between Lines	Distances in cm. Between Plants in the Line
Ubangi and Mongala	32,778	79.6	40.1
Bas-Uélé	32,889	71.5	55.8
Haut-Uélé	38,556	60,0	57.7
Total North	33,556	77.9	42.6

[1]Measured in a square of 9 m^2 (chosen at random in the field) and converted to a field size of 10,000 m^2 (1 hectare).

Field Maintenance and Harvesting

Farmers thinned cotton plants on the average 2.7 weeks after planting. No cotton fields were ridged. On the average, fields were weeded 2.5 times.

Farmers generally pick their cotton crop too late. As a result, the ripe cotton bolls are exposed to rain and insect attacks and many cotton bolls fall on the soil and are lost. Most of the farmers, though not all, burn cotton stalks and debris after harvest as prescribed by law.

Cotton Diseases

Although ONAFITEX has been treating some cotton fields with a combined insecticide-fungicide beginning in 1972 many fields are left untreated, and the timing and the rate of application are far from ideal. The dispersion of cotton fields is a major bottleneck in pesticide treatment.

A systematic study of the evolution of cotton pests in various regions has not been undertaken although ONAFITEX recognizes the importance of such a study. One important lesson learned during the intensification of cotton production before 1960 and, more recently, in Eastern Kasai (FED Project) and in FIWA-BILI is that cotton pests tend to become more important when production and yields rise in an area.

Number and Size of Other Fields

From Table 6.16 we can derive the average number of other fields per farm as 1.0 fields. The average size of other fields is presented in Table 6.17. Coffee is the most popular crop besides cotton with an average 0.46 fields per farm, while the most important food crops are rice and manioc. The average field size for the North was 46 ares, larger than the average size of cotton fields which was 33 ares.

Farm Sizes

There are several ways of defining farm size in African agriculture. One way is to define farm size as the sum of all acreage under cultivation at a given point in time. Table 6.21 provides us with data on farm sizes of cotton farms in northern Zaire according to this definition. Farm sizes vary widely between sub-regions and between farms, and the standard deviations for farm size are high, particularly in Ubangi-Mongala (160 ares) where the standard deviation is larger than the average farm size. One farm had 1,020 ares of coffee and 1,000 ares of oil palm and a total farm size of 1,276 ares. If this farm is left out of the sample, however, average farm size for Ubangi-Mongala drops to 85.4 ares with a standard deviation of 58.9 and for the North, to 66.17 with a standard deviation of 53.0.

Table 6.21. Average Total Farm Size and Standard Deviation, Northern Zaire, 1972-1973 (in Ares)[1]

Sub-Regions	Average Total Farm Size	Standard Deviation
Ubangi and Mongala	113.6	160.0
Bas-Uélé	34.3	26.5
Haut-Uélé	53.7	30.3
Bas- and Haut-Uélé	41.0	29.2
Total North	83.0	126.0

[1]Measured after planting of cotton and before harvest.

Since farmers always have fields in fallow we can include them in another definition of farm size. We can define farm size as the acreage of land under cultivation plus the acreage of land in fallow. If we define r, the coefficient of rotation, as the ratio of acreage under cultivation and acreage under cultivation plus acreage under fallow, then r = 0.20 means that only 20 percent of the land of a farm at a given point in time is cultivated. In the section on "Crop Rotations and Duration of Fallow" we listed average fallow times per sub-region for crop rotations with cotton. The average cultivation time of a crop rotation with cotton was about three years. The rotation coefficients per sub-region are, then, as follows:

Ubangi-Mongala:	3.0 / 3.0 + 5.2 = 0.37
Bas-Uélé:	3.0 / 3.0 + 9.0 = 0.25
Haut-Uélé:	3.0 / 3.0 + 8.0 = 0.27
Total North:	3.0 / 3.0 + 6.5 = 0.32

If we assume that these rotation coefficients apply equally to all fields on cotton farms, then farm size is as follows:

Ubangi-Mongala:	113.6 x 1 / 0.37 = 307.0 ares
Bas-Uélé	34.3 x 1 / 0.25 = 137.2 ares
Haut-Uélé	53.7 x 1 / 0.27 = 198.9 ares
Total North:	83.0 x 1 / 0.32 = 259.4 ares

With this definition, the differences in farm sizes between sub-regions are less pronounced because small farms in terms of acreage under cultivation (for instance in Bas-Uélé) have longer fallow times than the larger ones. The larger the farms, the shorter fallow times tend to become.

Cotton Yields

Table 6.22 presents the average physical yield per farm in kg. per ha. and in kg. per farm together with average cotton acreage per farm. The average yield in kg. per ha. is computed by dividing the survey production by the survey acreages per sub-region.

The average yield per farm in kg. per ha. differs widely between sub-regions. Yields in Bas-Uélé are more than double those in Ubangi-Mongala. Yields also vary considerably between farms as shown by the

Table 6.22. Average Cotton Acreage per Farm, Average Cotton Production per Farm, Average Yields and Average Cotton Revenue per Farm, Northern Zaire, 1972-1973

Sub-Regions	Average Cotton Acreage per Farm	Average Cotton Production per Farm	Average Yield Per Farm in Kg. per Ha.	Average Yield in kg. per ha.[1]	Average Cotton Revenue Per Farm in K.
Ubangi and Mongala	40.0 (20)[2]	103 (110)	257 (208)	257	648
Bas-Uélé	33.2 (21)	250 (327)	687 (453)	753	1573
Haut-Uélé	25.1 (19)	94 (82)	436 (286)	376	593
Total North	35.7 (21)	139.7 (198)	399 (351)	391	879

[1] Survey production divided by survey acreage for each sub-region.

[2] The figures between brackets are standard deviations.

high standard deviations. And there is an inverse relation between cotton acreage per farm and yield: the higher the cotton acreages, the lower the yields in kg. per ha.

The highest yields were obtained in the Buta and Bambesa zone in Bas-Uélé with an average yield per farm for these two zones of 908 kg. per ha. (standard deviation 467 kg.; 16 observations). The highest farm yield was in Kumongino, locality of Monge, Bambesa zone with 1,704 kg. per ha. (201 kg. on a field of 11.7 ares). Of the fields in the survey 2.7 percent had a zero yield as they were completely overgrown by Imperata Cylindrica.

The average cotton revenue per farm in K is also presented in Table 6.22. Revenues in Bas-Uélé were more than double those in Ubangi-Mongala and Haut-Uélé, mainly because yields in kg. per ha. were much higher in Bas-Uélé. On the average, farmers earned with cotton production a gross revenue of 8.79 Z

Cotton Prices

Knowledge of Cotton Prices

Of the farmers interviewed, 17.6 percent believed that the seed cotton price was a fixed price which did not change from year to year, while 30.2 percent of the farmers could not recall the price they had received during the previous year. Several farmers did not understand the concept of price; instead they considered the total amount of money which they had received from their cotton sale as the "price." The agricultural monitors and the territorial agronomists were the principal sources of information about cotton prices (Table 6.23). Most farmers learned about the cotton price on the day of the sale or only a few days before.

Table 6.23. Sources of Cotton Price Information for Farmers, Northern Zaire, 1972-1973

Sources of Information	Ubangi and Mongala	Bas-Uélé	Haut-Uélé	Total North
Agricultural Monitors	48.1	60.6	50.0	51.6
Territorial Agronomist	36.3	---	20.0	24.6
Nobody	10.4	33.3	---	14.6
Village or Clan Authorities	1.3	6.1	30.0	6.9
ONAFITEX Agents	2.6	---	---	1.5
Neighbors	1.3	---	---	0.8
Total Percentage	100.0	100.0	100.0	100.0

Importance and Effect of Cotton Prices

The price of cotton is an important factor in determining cotton acreages. Indeed, 67.7 percent of the farmers affirmed that the price over the last five years had influenced the size of their cotton holdings. The farmers were asked, respectively, at what price of first grade cotton they would increase their cotton acreage, at what price they would double their cotton acreage, at what price they would decrease their cotton acreage, at what price they would reduce their cotton acreage to half and at what price they would stop growing cotton. These questions were posed assuming that there was no obligatory cultivation. The enumerators were carefully trained to explain these questions to the farmers. Nevertheless, some responses had to be discarded because some of the farmers could not answer the questions properly.

The results of this inquiry are presented in Table 6.24. These data should be interpreted with caution. However, we do believe that

Table 6.24. Respective Prices for First Grade Seed Cotton at which Farmers would Change their Cotton Acreage and Prices which Farmers Deem Reasonable, Fair, Northern Zaire, 1972-1973 (Prices in K. per kg.)

Sub-Regions	Increase Cotton Acreage	Double Cotton Acreage	Decrease Cotton Acreage	Reduce Cotton Acreage to Half	Stop Cotton Production	Reasonable, Fair Price	Official Price at Time of Survey
Ubangi and Mongala	15.8	19.3	3.1	2.6	1.0	24.0	6.5
Bas-Uélé	10.7	14.1	4.0	2.8	1.4	10.7	6.5
Haut-Uélé	8.5	11.3	4.5	3.4	2.0	10.7	6.5
Total North	13.7	17.0	3.5	2.7	1.2	16.3	6.5

the data are indicative of a general picture which can be portrayed as follows: farmers conceive present cotton prices as low as indicated by the high prices needed before they will increase and double their cotton acreages. Also, prices would have to decline by a large amount before they would decrease their cotton acreage. Prices could decrease by 25 percent and cotton acreage would not change very much; but if the price dropped 50 percent (from 6.00 K. on the average to 3.00 K. per kg.), the acreage would fall by the same magnitude. Thus, at present cotton prices, farmers seem insensitive to small price changes. ✓

Farmers reported that they considered 16.3 K. per kg. a fair or reasonable price for cotton which is more than double the current price. The Uélés are more sensitive and responsive to changes in prices than Ubangi-Mongala. Farmers in the Uélés would increase cotton acreages sooner when prices are rising, reduce acreages earlier when prices are falling and stop growing cotton at a higher price than the farmers in Ubangi-Mongala. They consider 10.7 K. per kg. a reasonable or fair price, at less than half the level which farmers in Ubangi-Mongala deem reasonable.

The Risk of Growing Cotton

For many farmers cotton is the only cash crop which procures a fair amount of cash and which enables them to pay their head tax and other taxes. About half the farmers interviewed (48.8 percent) believed that cotton had earned them a lot of money during the past years. But 96.1 percent of the farmers also considered cotton a risky crop, i.e. a crop which may yield a lot of money in one year but not in another year.

Sale of Seed Cotton

Time and Conditions of Sale

Most farmers (60.9 percent) sell their cotton at two periods of time: a first market for first grade cotton and a second market for the remaining first grade and all of second grade. Those who sell all their cotton in one market either have no second grade cotton to sell or simply missed or skipped one of the markets.

The majority of the farmers, 94.8 percent, sold all the cotton they had harvested. The reasons for not selling all cotton were several: absence of the farmer during a market, refusal to buy because of poor quality, late harvest or remoteness of a buying center from the homestead of the farmer.

Only 1.6 percent of the farmers did not store their cotton crop in baskets or on a drying rack in a cotton shed but instead dumped it on the earth floor. All farmers but one transported the cotton themselves to the buying center. The buying center was on the average 1.88 km. from the house of the farmer.

No farmer knew in advance the weight of seed cotton he was bringing to the buying center, and 2.0 percent of the farmers saw their grade classification changed by ONAFITEX buying agents from first grade to second grade.

In 1972 first grade cotton was sold on the average around mid-March, with extremes running from mid-January to October. Indeed, farmers never know exactly when their seed cotton crop will be bought. On the average, 85.9 percent of the cotton harvest was classified as first grade and 14.1 percent as second grade.

Willingness to Join a Sales Cooperative

Only 21.4 percent of the farmers expressed an interest in joining a sales cooperative for cotton which would collect and weigh seed cotton, transport it to the ginning mill, distribute seeds and pay the farmers.[12] The main advantages farmers expected from a cooperative were timely buying-up of seed cotton and the services of a truck, while the principal reasons for rejecting a cooperative were examples of cooperatives that had failed in the past and mistrust of cooperative management.

The Agricultural Extension Service

On the average 87.5 percent of the farmers knew an agricultural monitor (or agricultural extension agent), either from the Department of Agriculture, ONAFITEX or the Local Collectivity. For those who knew one, 78.6 percent believed that they had helped them in producing cotton. Help offered by agricultural monitors included recommendations for finding a suitable location for cotton fields, determining the size of the field, crop rotation, planting time, spacing, number of seeds to put in each pocket, timing and method of thinning and weeding, time of harvest, sorting method and, in general, for every aspect of the cotton growing process. They also inspected cotton fields and encouraged farmers to produce more. Some agricultural monitors treated cotton fields with pesticides. Still, the single most important advice was the date of planting.

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[12]This type of farmer cooperative, assuming the Phase 1 operations of cotton marketing, was specifically proposed in the cotton decree law of August 13, 1965 and is referred to in the ordinance law of August 12, 1971 creating ONAFITEX. In this latter ordinance, farmer cooperatives are also proposed for cotton ginning and, thus, for Phase 1 and Phase 2 operations.

The territorial agronomist, a powerful administrator in each zone, is less well known by the farmers. On the average, 67.2 percent of the farmers knew him. Of those who knew him, 74.7 percent indicated that he had helped them in cotton production. His help consisted mainly of control of agricultural monitors and enforcement of cotton growing requirements, particularly time of planting and weeding. He was also closely associated with the fines imposed for negligence of cotton growing requirements; thus, farmers feared him.

Of the farmers questioned, 16.4 percent also knew other persons who had helped them in cotton production. These were mainly foremen in a village who worked under instructions from the agricultural monitors. Some farmers also mentioned village or clan authorities who recommended the same practices as agricultural monitors or territorial agronomists. Finally, 83.6 percent of the farmers believed that the help of agricultural monitors and the territorial agronomist and capitas was needed to produce more cotton. The remainder of the farmers, 16.4 percent, believed that their help was redundant.

Livestock and Poultry

Farmers in northern Zaire generally do not keep large animals. Some village chiefs keep a small herd of cattle, but this is rather exceptional. The area is infested with tsé-tsé flies except in the northern savannahs where there are large cattle ranches. No farmer in the survey had cattle.

Farmers in Ubangi-Mongala kept more animals than those in the Uélés. A possible explanation is that most farmers in the Uélés have not been able to build up their animal stock because of the massive slaughtering of domestic animals during the Congo rebellion. Farmers in savannahs also kept more animals than farmers in forest areas.

Goats were the most popular large animals on farms with an average of 0.91 goats per farm. Hogs, guinea pigs, rabbits and hares were found only in Ubangi-Mongala. Poultry was very popular in all regions with an average of 9.43 units per farm. Ducks were popular in Ubangi and pigeons in Bas-Uélé.

Farmer's Revenues, Expenditures and Savings

Sources of Farm Revenue

Food crops and nonfood crops are about equally important in providing revenues for farmers. In Ubangi-Mongala food crops are the primary source, while in Bas-Uélé nonfood crops, particularly cotton, are far more important than food crops. Table 6.25 provides a ranking of the major sources of sales revenue from food and other crops.

Table 6.25. Sources of Farmers' Revenues, Northern Zaire, 1972-1973

Source of Revenue	Ubangi and Mongala	Bas-Uélé	Haut-Uélé	Total North
Food Crops	59.0	22.6	47.6	48.5
Other Crops	41.0	77.4	52.4	51.5

Forty-two percent of the farmers ranked cotton as their first and 23 percent as their second most important source of sales revenue. For 18 percent of the farmers, coffee was the main source of revenue. Cotton is by far the primary source in Bas-Uélé where 84 percent of the farmers ranked cotton in first place, while in Ubangi-Mongala coffee was judged more important than cotton (29 percent versus 23 percent). Of the farms in Ubangi-Mongala, 22.1 percent are in a coffee paysannat and this may explain why coffee ranks first.

Taxes Paid by Farmers

All able-bodied adult males have to pay a personal minimum tax. On the average, 81.4 percent of the cotton farmers paid the head tax. The following are exempt from the tax: old farmers, sick or handicapped farmers, divorced wives, war veterans and the village or clan authorities. This tax is collected once a year and the collection usually coincides with the market for seed cotton. The tax levied was 2.00Z or 2.80Z, depending on the location. Farmers with two wives paid double the tax rate. The average tax collected was 2.47Z per farmer.

Most farmers also pay other taxes in addition to the head tax. These taxes are either a membership fee in the political party,usually 20 K. per person, a road tax (taxe de voirie), 20 K. to 50 K., a bicycle tax, from 30 K. to 100 K, or a tax for the sale of palm wine, from 100 K. to 600 K. One of these additional taxes was paid by 64.3 percent of the farmers, and the average amount paid per farmer was 40.7 K. per year. The tax was usually collected once a year.

Some of the farmers, 8.5 percent, also paid taxes in kind. Usually, they were gifts in kind to authorities from the village or from the local collectivity.

Exchange of Money and Products with Family Members in Cities

Farmers often exchange gifts with members of their families or clan who are residing in cities. In fact, 10.1 percent of the farmers received gifts from members of their families living in a city. These gifts were usually cash, on the average 9.85Z in 1972. In return, farmers give food products to their family members in cities; of those in the survey, 15.5 percent gave food products to family members in the city. The usual gifts were poultry, slain wild animals (especially monkeys), bananas, termites, goats, fish, groundnuts, paddy, palm oil, beans, etc. The average total value of these gifts in 1972, at local prices, amounted to 2.38Z

Savings, Lending, Borrowing and Expenditures

The proceeds from the sale of cotton are either kept by the farmer himself or the farmer and his wife split the cash (Table 6.26).

Table 6.26. Responses to Question: "Who Keeps the Proceeds from the Sale of Cotton?", Northern Zaire, 1972-1973 (In Percent)

Sub-Regions	Farmer	Wife	Splitting
		Percent	
Ubangi and Mongala	63.3	11.7	24.7
Bas-Uélé	13.3	16.7	70.0
Haut-Uélé	11.8	0.0	88.2
Total North	44.3	11.3	44.4

The men spent the money mainly on clothing, taxes and drink, the women on clothing and food. All farmers but one kept their money at home; one farmer in Haut-Uélé deposited his cash in a savings account in a savings and loan institution (CADEZA) in the nearest city.

In many areas of Zaire and particularly in the cities, a mutual savings plan, called "likelemba," is very popular. It is a sort of savings club with rotating disbursement. A number of individuals pool their money at regular intervals and, in turn, each one of the participants receives all the cash; 21.9 percent of the farmers participated in such a scheme. The average number of participants was 8.15. The average contribution was 1.42Z

Farmers were asked about their lending and borrowing practices. On the average, 32.6 percent of the farmers had loaned money to other persons in the past. No interests were paid, in fact, the concept of interest was never encountered in these transactions. The average amount of money advanced was 2.14Z. With respect to borrowing, 14.0 percent of the farmers had borrowed money in the past. The average sum borrowed was 1.24Z and repayment usually occurred after the sale of agricultural products.

When asked what they would do if they earned an additional 10Z, or 30Z, or 100Z, farmers frequently mentioned, among other things, the hiring of day-laborers for their cotton or coffee field and, for the 100Z question, the opening of a trading business.

Visits to Local Markets

The market visited most frequently by farmers was, on the average, 9.6 km. from his house; 80.6 percent of them regularly returned from the market with unsold products. Twenty-six percent of the farmers went to the city on a regular basis to buy and sell products. The city was on the average 35.5 km. from the village of the farmer. Most farmers (67.2 percent) believed that the shops and markets in their area were sufficiently stocked with products.

Dowry

Traditionally, the bridegroom has to pay a dowry to the parents of the bride. Part of it is usually paid at the time of marrying and the remainder is paid after children are born. Although the amount and composition of the dowry vary widely from region to region and from one ethnic group to another, the dowry usually consists of a cash gift and gifts in kind. Farmers in the survey were asked what they would demand as dowry for one of their daughters. Answers seemed to depend on the wealth and standing of the bridegroom's family. Also, if the bride had been to school, the dowry was usually more than double the normal amount.

The following average figures were obtained for the cash share of the dowry: for Ubangi-Mongala, 48.8%, for Bas-Uélé, 14.8%, and for Haut-Uélé, 13.3%. The average for the North was 34.8%. Thus, the dowry represents a considerable outlay of money relative to the farmer's income. Many young men are unable to pay the dowry or can only marry in their late 20s when they have amassed enough cash.

Farmer's Possessions

All farmers lived in houses made of mud and wood sticks with a thatch roof. None had a tin roof. Most houses had a wooden entry door which could be locked. The degree of material wealth could be measured in the possession of the following goods: bicycle, radio, sewing machine and watch. Some farmers also had shotguns, although no accurate information could be collected on this item because they hid the possession from authorities. The percentage of cotton farmers who owned one of these goods is given in Table 6.27.

Table 6.27. Percentage of Cotton Farmers Who Owned a Bicycle, Radio, Sewing Machine or Watch, Northern Zaire, 1972-1973

Sub-Regions	Bicycle	Radio	Sewing Machine	Watch
Ubangi and Mongala	14.3	5.2	7.8	1.3
Bas-Uélé	35.5	12.9	9.7	---
Haut-Uélé	19.0	4.8	---	---
Total North	20.2	7.0	7.0	0.8

On the average, one out of every five farmers owned a bicycle. These bicycles are always used to transport produce to markets. They increase the range of sales opportunities open to farmers and bring them closer to urban centers, and are usually a precondition for opening a small shop for petty trading which may eventually evolve into a larger shop. Seven percent of the farmers also owned a small transistor radio. This is probably very important in shaping the beliefs and values of farmers. It is also a potential source of information for better methods of agricultural production, although, presently, the radio is not much used for agricultural extension.

Farmer's Attitudes Regarding Cotton Production Based on Open-Ended Questions

At the end of the survey farmers were asked a series of open-ended questions in order to learn about their attitudes, beliefs and values regarding agriculture and, in particular, the production of cotton.

Do People Like to Grow Cotton?

A large majority viewed cotton as an important source of money, while some farmers also thought of cotton as a source of food. Cotton is part of the food crop rotation and money from the sale of cotton enables them to buy dried fish, salt, and other food products. Across all sub-regions the majority of the farmers indicated that they like to grow cotton. Only 16.3 percent of the farmers complained that the cotton price was too low.

Why Don't You Produce More Cotton?

The answers varied among sub-regions. In Ubangi-Mongala low seed cotton prices were given as the main reasons for not producing more. The other main reasons given were poor soils, bad seeds, illnesses and old age and a variety of other constraints. In the Uélés illnesses and old age were viewed as the main reasons; farmers complained about their poor health. In Bas-Uélé 34.6 percent of the farmers believed that they work enough already and can not produce more.

Why Do Some Farmers Abandon Cotton Production?

This question overlaps with "Do People Like to Grow Cotton?" Of the farmers in the survey, 67.8 percent said low cotton prices were the main reason for abandoning cotton production. A similar reason was their preference for coffee which yielded higher returns to labor. Such responses confirm the main reason why people like to grow cotton: for the money it provides.

The second most important motivation for abandoning cotton, in the eyes of those who grow cotton, was lack of discipline and motivation of farmers. Farmers in the Uélés saw this as the primary reason. In Bas-Uélé 28 percent of the farmers also mentioned late sale of cotton as a reason for abandoning production.

What Should Be Done to Encourage More Cotton Production?

This question follows logically the question of "Why Don't You Produce More Cotton?" Again, farmers in Ubangi-Mongala were the most price conscious; about 60 percent requested an increase in price. All farmers in the North asked for farm tools, machinery and gifts from the government. During the COTONCO days, farmers regularly received free farm tools or at half price in addition to gifts of salt and other products in proportion to their cotton production. ONAFITEX abolished this paternal practice although, obviously, farmers appreciated these gifts.

Only one out of every ten farmers mentioned pesticide treatment as a stimulus to producing more cotton. In Bas-Uélé one out of every four farmers asked for measures to protect his fields from wild animal damage, mainly elephants and cynocephalus (monkeys).

What Kind of Help Do You Like to Receive From the Government, ONAFITEX or Others to Produce More and Better Cotton?

This question is complementary to the previous one. Again, farm tools, a bicycle and gifts received priority. Increasing the cotton price ranked low (3.2 percent of the farmers) but, then, money or credit were asked for by one-third of the farmers. Pesticide treatment was requested by only 7.1 percent of the farmers. No farmers mentioned better extension services, probably because they didn't like the paternal approach of extension agents.

Summary

One-hundred and twenty-nine cotton farmers were interviewed twice--once before harvest and once after harvest--during the 1972-1973 cotton production year. The average age of the farmers was 44 years. The average years of formal schooling was 1.4. Each family was composed of 5.0 persons.

Land tenure was no constraint on cotton production. On the average 86.0 percent of the farmers were under obligation to grow cotton. Stiff fines and/or jail terms were given to farmers who ignored cotton growing requirements. Only one-third of the farmers decided where to locate their cotton fields and only one-tenth determined their cotton field sizes. Agricultural monitors and to a lesser degree territorial agronomists and village or clan authorities were primarily responsible for determining the location and size of cotton fields.

The average cotton acreage per farm was small: 35.7 ares, less than one acre. There was a large variation in cotton field sizes between farms. Average farm size was 83.0 ares (113.6 ares in Ubangi-Mongala, 34.3 ares in Bas-Uélé and 53.7 ares in Haut-Uélé).

The average seed cotton yield per farm in kg. per ha. was 399 kg. (257 kg. in Ubangi-Mongala, 687 kg. in Bas-Uélé and 436 kg. in Haut-Uélé). Yields differed widely between farms and between sub-regions. On the average, farmers earned a gross revenue of 8.79Ƶ from cotton production.

Cotton was ranked as first source of sales revenue by 42 percent of the farmers; 23 percent also ranked cotton as the second most important source. For 18 percent of the farmers, coffee was the first source. Farmers paid an average head tax of 2.47Ƶ per year. Most farmers also had to pay other taxes. The average cash portion of the dowry was 34.8%.

Most farmers had to help repair the roads for an average duration of 6.7 weeks per year and about half of the farmers also had to work for the chief of the village or head of the clan for an average of 10.5 weeks per year. This was a constraint on cotton production.

The farmers possessed only a small number of machetes, hoes and axes. Chemical fertilizer was unknown to farmers. Some farmers (12.9 percent) received cotton seeds too late. Fields were planted one to three weeks after the optimal time of planting. The recommended crop rotations were generally observed although cotton was almost never grown in a pure stand. Fallow time was on the average 6.5 years, far below the recommended period of 10 to 20 years. Cotton fields were located an average of 1.9 km. from the compound of the farmer. Cotton plant densities were fairly uniform but well below the recommended density. Cotton maintenance was generally poor and farmers harvested too late. Of the farmers interviewed, 87.5 percent knew an agricultural extension agent. The territorial agronomist was less known by the farmers.

Most farmers learned about the cotton price on the day of sale or only a few days before. They were generally unaware of the day of collection. The majority of the farmers (67.7 percent) affirmed that the producer price over the last five years had influenced their decision to plant more or less cotton. Farmers conceived present cotton prices as low. However, farmers reported that prices would have to fall considerably before they would reduce their cotton acreage. At present cotton prices farmers seemed insensitive to small price changes. Farmers in the Ueles were the most sensitive to price changes. Almost all farmers considered cotton a risky crop. Only one-fifth of the farmers expressed an interest in joining a sales cooperative for cotton.

Most farmers like to grow cotton for the cash income it provides. However, they do complain about the low seed cotton price and the small amount of money they earn with cotton. They expect the government to raise cotton prices and provide farm tools, machinery and gifts as incentives to expand production.

CHAPTER VII

AN ANALYSIS OF THE RETURNS TO LABOR FOR COTTON AND OTHER SELECTED COMMODITIES IN NORTHERN ZAIRE

Introduction

The objective of this chapter is to compare the returns to the factors of production on traditional farms in northern Zaire. In particular, the returns to labor will be analyzed because labor and land are the dominant inputs in traditional agriculture in northern Zaire. A framework will be presented for comparing the returns to labor for different crops. The real price of seed cotton since 1960 will be derived in order to compare the returns to labor in cotton production over time.

Methodology

The factors of production that are traditionally taken into consideration by farm management and production economics researchers are land, labor and capital. Management is viewed as the art of combining these different factors. We assume that "average" management is incorporated in the labor input. No separate returns to management will be considered.

Returns to Land

In this survey of 129 farmers none of the farmers experienced difficulty in acquiring more land. As a result, we will consider land a nonlimiting factor; farmers can obtain as much of it as they desire. Thus, no returns will be imputed to land in our analysis.

Land is not a homogeneous input and, in reality, returns do accrue to fertile land above those to "average" land. It is reasonable to assume that farmers or those who select plots of land will choose the most fertile soils at the beginning of the crop rotation. These are usually soils which have been under a long forest or savannah fallow. The longer land remains under fallow, the more labor is needed to clear it and the better is soil fertility.

Returns to Capital

Under present production technologies, very little capital is used in traditional agriculture in northern Zaire. This is true for food crop production as well as for perennial and export crops grown in traditional agriculture. Capital items such as hoes, hatchets, machetes, axes,baskets, etc. are extremely limited. Some of the equipment was supplied by COGERCO as a bonus for cotton production or has been made by the farmer himself such as baskets, storage sheds, drying racks, etc.

In the entire northern cotton belt we did not encounter any cotton farmers who applied chemical fertilizers or pesticides. ONAFITEX did treat cotton fields with pesticides, but the farmers did not bear the costs for these operations directly. For these reasons, we will assume that no returns accrue to the capital input.

For perennial crops in modern plantations, capital is very important resource and cannot be neglected. Capital is used in the form of soil improvements, infrastructure works, mechanization, pesticides, fertilizers, improved seeds, etc. and, in general, in forms which substitute for labor.

Crops in modern plantations will not be analyzed in this chapter as we are focusing on crops grown with traditional production practices.

Returns to Labor

Labor is the only factor of production which we will consider in this analysis. It is the most important productive resource in traditional agriculture in northern Zaire at this time and it constitutes the only "cost" of production in our analysis. We will compute the returns to this factor for cotton and other competitive crops.

Labor Assumptions

It is assumed that the expected returns to labor in different crops are the most important factors in the decision-making process of traditional farmers. This is in conformity with the economic rationality of traditional farmers which has been documented by several authors [Verhaegen, June 1967; March 1968 and Jones, May 1960].

Labor inputs are measured in terms of duration and not in labor characteristics of arduousness and urgency of the task being performed. The latter are uncommon and difficult to measure. Thus, "normal" labor inputs on a given plot of land over time are considered. The unit of measurement of labor is man days on a field of one hectare (ha.).

Men and women are given the same weights in estimating standard man days, namely 1.0. The labor of children is not considered in deriving standard labor inputs.

For annual crops grown in a rotation, the labor requirements for land clearing and land preparation are divided evenly among the four crops which are usually grown in a rotation: cotton, maize or paddy, groundnuts or paddy and manioc. Thus, each crop is allotted one-fourth of total labor requirements for land clearing and land preparation on a new field.

Determination of Standard Labor Inputs for Different Crops

The farm business survey on cotton production in northern Zaire did not generate accurate labor data for different crops grown on cotton farms. This is one of the main, if not the main drawback of farm business surveys or limited visit surveys. We will utilize standard labor rates derived by INEAC and published in 1958 as "Normes de Main d'Oeuvre. . ." [INEAC, 1958]. No other precise labor input data are available for Zaire.[1] These labor norms were derived by INEAC over the years based on observations of hand labor methods in its agricultural experiment stations, and are considered "normal" labor inputs for a crop and averages for a production system. Actual rates of work within and between farms over time will vary according to local ecological conditions, agricultural methods, nonfarm activities, health of the farmer, family composition, etc.

The advantage of utilizing labor data based on experiment station conditions is that they were derived under controlled and uniform conditions. But there is no doubt that the actual labor inputs on farms are different from those derived under experiment station conditions. Although the actual values of data generated under experiment station conditions may be somewhat suspect, the relative picture revealed

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[1]Mr. Paul Perrault, Stanford Food Research Institute, derived reliable labor data for banana production on traditional farms in the Kisangani area over the 1973-1974 period.

is unquestionably an accurate one. As a corollary, the returns to labor as calculated in this exercise probably do not reflect actual returns, but do indicate the relative returns to labor for different crops.

Only single crops or pure stands will be considered in this analysis.[2] Since virtually no labor data is available for the dominant crop mixtures in Zaire we are forced to restrict our analysis to single crops.

Estimates of Labor Requirements for Cotton Production

The labor requirements for cotton production in forest and savannah areas are given in Table 7.1, according to different sources of data. This table clearly shows that cotton fields in forest areas require more labor than in the savannah zones. The data from the "Normes de Main-d'Oeuvre" on which our analysis is based seem to be on the high side. Table 7.2 presents labor requirements for different activities in cotton production. There is considerable variation among authors. The requirements for land clearing according to the "Normes de Main-d'Oeuvre" seem high. These are only one-fourth of the total requirements. Harvesting and sorting data appear low for forest areas. Obviously more research is needed on actual labor allocation under field conditions.

Determination of Yields

There are several problems involved in the determination of yields of crops grown under African conditions [Spencer, September 1972; Norman, 1973]. The farm business survey on cotton provided us with accurate

[2] The theoretical problem of allocating labor inputs to crops within a crop mixture has not adequately been resolved [Norman, 1973]. Most authors regard the dominant crop mixtures as joint products in their analysis.

Table 7.1. Republic of Zaire: Estimates of Labor Requirements for Cotton Production in Forest and Savannah Areas (In Man-Days per Hectare)

Source of Data[1]	Forest Areas	Savannah Areas
Normes de Main-d'Oeuvre	225	198
Depy G.	209	174
Lumpungu Kamanda	...	189
Van den Abeele & Vandenput	187	178
COGERCO	...	130
Béguin H.	140	...
Van de Velde G.	... 224(2)	...

(1)Assuming six hours of work per man-day.

(2)Type of area not specified; calculated for a yield of 400 kg. seed cotton per ha.

[1]Normes de Main-d'Oeuvre [INEAC, 1958]; Depy G. [1954]; Lumpungu Kamanda [Novembre 1970]; Van den Abeele & Vandenput [1956]; COGERCO [1970]; Béguin [1958].

data on cotton yields but not yields of other crops. Therefore, we used the yield data from the "Normes de Main-d'Oeuvre," wherever possible and from the renowned book on crops in Zaire by Van den Abeele and Vandenput [1956] for the remaining cases. The source of yield data is indicated in Table 7.3.

Perennial Crops

In order to compare the profitability of perennial crops with annual crops, several working hypotheses have to be adopted. We propose the following:

--Total production of a farm with perennial crops is the product

Table 7.2. Republic of Zaire: Estimates of Labor Requirements for Different Activities in Cotton Production (In Man-Days per Hectare)

Source of Data[1]	Land Clearing	Land Preparation	Planting	Weeding and Maintenance	Harvest	Uprooting and Burning	Sorting	Transport and Sale	Total
Normes de Main-d'Oeuvre									
Forest Areas	112.5	14.0	15.0	40.0		34.0		...	225.5
Savannah Areas	18.0	24.0	25.0	64.0		67.0		...	198.0
Depy G.									
Forest Areas	95		80		25	10	50	...	209 (±15)
Savannah Areas	60		80		25	10	50	...	174 (±10)
Van den Abeele & and Vandenput (1)	(2)								
Forest Areas	20	23	10	55	40	10	15	14	187
Pennisetum Fallow	22	21	10	55	40	10	15	14	187
Savannah Areas	15	28	15	65	25	10	10	10	178
Van De Velde G. (3)	120.0	24.5	---	35.0	23.0	13.5	8.0	...	224.0
C.F.D.T. Mission (4)									
Forest Areas	145	69	42	74	...	...	...	...	...
Savannah Areas	70	141	23	65	...	...	...	...	...

(1) Labor data established for good cultural practices with hand labor methods only and for yields of 1000 kg. in forest areas and 600 kg. in savannahs.

(2) These data represent only one-fourth of total requirements because of equal allocation between all four crops in the rotation.

(3) Type of area not specified; calculated for a yield of 400 kg. seed cotton per ha.

(4) From the C.F.D.T. mission in Gemena: man-days from 6:30 a.m. to 11:00 a.m.

[1] Normes de Main-d'Oeuvre [INEAC, 1958]; Depy G. [1954]; Lumpungu Kamanda [Novembre 1970]; Van den Abeele & Vandenput [1956]; COGERCO [1970]; Béguin [1958].

Table 7.3. Estimates of Returns to Labor for Cotton and Other Selected Commodities in Northern Zaire, 1973-1974 (Makuta per Man-Day)

	Oil Palm	Robusta Coffee	Cocoa	Cotton in Forest	Cotton in Savannah	Rice (Paddy)	Rice (Paddy)	Groundnuts	Groundnuts	Maize	Maize	Manioc (Tubers)
Man-days per ha.[1]	1,204.7	3,557.2	1,349.1	225.5	198.0	454.1	454.1	415.6	415.6	247.2	247.2	731.5
Yield in kg. per ha.[2]	8,580 (V)	1,520 (V)	300 (V)	400 (V)	400 (V)	1,000 (V)	2,700 (N)	1,000 (V)	1,000 (V)	1,500 (V)	2,280 (N)	5,175 (N)
Production in kg. per ha.	137,280	24,320	4,800	400	400	1,000	2,700	1,000	1,000	1,500	2,280	5,175
Price in K per kg.	0.35	10.0	20.0	6.0	6.0	4.0	4.0	2.0	3.0	3.5	3.5	1.0
Gross revenue in K	48,048	243,200	96,000	2,400	2,400	4,000	10,800	2,000	3,000	5,250	7,980	5,175
Gross revenue in K per man-day[3]	39.88	68.36	71.15	10.64	12.12	8.80	23.70	4.81	7.40	21.24	32.70	7.00

[1]Labor requirements for a period of 20 years for perennial crops and for one production season for annual food crops and cotton.

[2]Annual average yield over a period of 16 years for perennial crops and average yield for one production season for annual food crops and cotton; (V) indicates source of data "Van den Abeele and Vandenput" and (N) indicates "Normes de Main-d'Oeuvre."

[3]Line six is obtained by dividing line 5 by line 1.

of annual average yield and the productive life time of the plantation, fixed at 16 years for all perennial crops. This is to conform with the "Normes de Main-d'Oeuvre" which have been calculated for a total plantation life of 20 years.

--The per unit product price remains constant over the productive life (16 years) of the plantation.

--The annual average yield remains constant over the productive life (16 years) of the plantation.

Price Data

The product prices used in this analysis are the prices fixed or commonly practiced in 1973. The form of the product is what is usually sold by the farmer to traders, processors, etc. such as oil palm nuts, dried unshelled coffee beans, dried cocoa beans, paddy, dried unshelled groundnuts, dry maize kernels and dried retted manioc chips.

Method of Analysis

The returns to labor of perennial crops are compared with those of annual crops by calculating the gross remuneration of one man-day of work in each crop enterprise. Thus, the basis for comparison is the imputed remuneration of a man who works one day in each crop. In principle, this is the wage which could be paid to an unskilled laborer.

The total lifetime earnings of a crop or the annual revenues which a farmer receives from a particular crop or sequence of crops are not analyzed in this chapter. Such an analysis requires knowledge about the number of crops grown, the crop mixtures and sequences of crops per

year, crop rotations, duration of fallow, etc. which are beyond the scope of the present analysis.

Results

The detailed data and calculations of the returns to labor for different crops can be found in a paper prepared by the author for a conference on agricultural development problems in Zaire [Tollens, 1974a]. The results are summarized in Table 7.3.

Analysis of the Results

The difference in gross revenue per man-day between perennial crops and annual food crops and cotton is very pronounced. The returns to labor for perennial crops are on the average more than double those of annual crops and cotton.

The perennial crops—cocoa and coffee--yield the highest returns per man-day. The highest returns to labor are realized for cocoa.[3]

The returns to labor on cotton are about the same as the returns to food crops. The returns to cotton and food crops are below the minimum wage rate for unskilled labor in rural areas which varies between 18 and 35 K. per day, according to the regions.[4] Cotton production in savannahs yields higher returns to labor than in forest areas, under the same yield assumptions.

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[3] In Zaire cocoa is almost completely produced on large commercial plantations. It was never promoted as a smallholder cash crop as in Ghana or Nigeria. It would be interesting to study why in Zaire cocoa (and coffee) were predominantly produced on commercial plantations and were not introduced on a large scale in traditional agriculture.

[4] "Salaire Minimum Interprofessionnel pour Manoeuvres Ordinaires, Zone III" in CADICEC, 1973. Code du Travail-Mesures d'Application. Kinshasa: éditions CADICEC.

With good yields, maize and rice production provide returns to labor above the minimum wage rate. However, there is often no regular market for food crops in remote rural areas. In northern Zaire farmers often cannot sell maize, manioc nor groundnuts because of the lack of buyers. At the time of this farm business survey, a regular guaranteed market outlet existed only for cotton, rice and coffee. Recently, new product marketing offices have been created which may provide regular sales opportunities for a variety of agricultural products in the remote areas.

This analysis considered land and capital as nonlimiting factors under the present technologies of production. No returns are assumed to accrue to these factors. Thus, the returns to labor as presented in Table 7.3 are to be considered as upper limits.

The Real Purchasing Power of Seed Cotton Since 1960

Since 1960 the real purchasing power of cotton has declined drastically. In fact, the real purchasing power of seed cotton as measured against the price index of 61 common consumer goods in Kinshasa declined from 149.3 in June 1960 to 100.0 in December 1964 and 72.4 in December 1973 (Table 7.4). And, as we can safely assert that on the average, prices of consumer goods in the interior rose relatively more than in Kinshasa, the "terms of trade" for cotton farmers deteriorated even more than shown in Table 7.4.

Since December 1964 the index of real purchasing power of seed cotton has oscillated widely between 100.0 and 58.2. Rapid inflation has eroded the purchasing power of seed cotton. At the end of 1973 the index was at the level of that of December 1966, far below the index for June 1960 which had then reached 149.3.

Table 7.4. Index of Real Purchasing Power of Seed Cotton in Zaire, 1960-1973

Year		Seed Cotton Price Grade 1[1]	Producer Price Index	Price Index of 61 Consumer Goods in Kinshasa[2]	Index of Real Purchasing Power of Seed Cotton[3]
June	1960	6.00	33.3	22.3	149.3
December	1960	6.00	33.3	25.0	133.2
"	1961	6.00	33.3	33.8	98.5
"	1962	6.00	33.3	60.9	54.7
"	1963	8.00	44.4	87.4	50.8
"	1964	18.00	100.0	100.0	100.0
"	1965	18.00	100.0	108.7	92.0
"	1966	18.00	100.0	137.1	72.9
"	1967	24.00	133.3	229.0	58.2
"	1968	3.60	200.0	284.0	70.4
"	1969	3.60	200.0	310.8	64.4
"	1970	4.50	250.0	325.3	76.9
"	1971	4.50	250.0	338.1	73.9
"	1972	6.50	361.1	369.8	97.6
"	1973	6.50	361.1	460.5	78.4

[1]Price in francs per kg. until 1967 and K/kg. from 1968 on.

[2]"Index des Prix de Détail de Biens de Consommation Courante aux Marchés de Kinshasa," Kinshasa: National University of Zaire, I.R.E.S., published in "Cahiers Economiques et Sociaux".

[3]Obtained by dividing the second column by the third column.

This analysis shows that, other things being equal, the real value of the cotton crop and the real returns to labor for cotton production are now much lower than during the colonial administration.

Summary

The returns to labor in cotton production are comparable with those for food crops if a market outlet exists for these products. However, these returns are below the legal minimum wage of unskilled workers in rural areas. Perennial crops (export crops) earn much higher returns to labor than cotton with cocoa the most profitable crop followed by coffee and oil palm. These returns are well above the legal minimum wage. Precise resource utilization and yield data are needed for a more thorough analysis of the financial profitability of cotton and other crops.

In December 1973 the real purchasing power of seed cotton was about half of the June 1960 level. Thus, other things being equal, the real returns to labor for cotton production are now much below those of 1960. This researcher strongly believes that erosion of the farmers' real purchasing power of seed cotton explains a large part of the lack of interest in cotton production, low yields and the present low levels of production.

Presently, cotton farmers can derive much higher labor earnings per day from other crops than cotton, particularly coffee, which has expanded greatly among smallholders since 1965. Maize and paddy can also be more profitable if there is an assured market outlet at the official minimum purchase price.

CHAPTER VIII

ANALYSIS OF THE MAIN DETERMINANTS OF COTTON PRODUCTION IN NORTHERN ZAIRE

In Chapter VII an attempt was made to determine the returns to labor for cotton production and for other crops using experiment station labor data. Our analysis revealed that the returns to labor in cotton production, at 1973 prices, were well below those for perennial crops and on a par with those for annual food crops. The returns to labor are a function of the price of seed cotton and the physical labor productivity. We found in Chapter VII that the real price of seed cotton paid to farmers has declined drastically since 1960. This implies, other things being equal, that the real returns to labor for cotton production are now much lower than in 1960.

The purpose of this chapter is to analyze the main determinants of cotton production in northern Zaire and attempt to explain the major decline in production since 1960.

Production is the product of yields per unit of acreage and the number of acreages planted. In Chapter VI, we identified several factors depressing yields in many areas. They were: short duration of fallow, field plots on marginal soils, poor land preparation, low cotton plant densities, late planting of cotton seeds over an extended period of time, poor crop maintenance, particularly thinning and weeding which are performed too late, insect and disease attacks, planting crop mixtures instead of a pure stand of cotton, late harvest of cotton and generally, inadequate incentives to produce cotton. With respect to acreages, we found in Chapter VI that the location of cotton fields and the enforcement of cotton growing requirements and field size by agricultural monitors, territorial agronomists and village or clan authorities were important factors in determining cotton acreages in northern Zaire. Yields will be analyzed in this chapter using a multiple linear regression technique. An attempt will be made to determine the price elasticity of supply (supply in terms of acreages planted), using nominal prices. The variation in cotton acreages between farms and between sub-regions and regions will be analyzed using a multiple linear regression equation model. Finally, we will compare the number of cotton farmers, acreage per farm and yield in kg. per ha. and kg. per farm for 1958-1959 with 1970-1971 and 1972-1973.

Yields

Yields are defined as the physical production either in kg. per ha. or in kg. per farm. In this section, however, we will analyze yields in terms of kg. of seed cotton per hectare; our objective is to explain the differences in yields between farms and between regions and sub-regions.

Several factors determine yields and they can be categorized as bio-technical factors (soil, climate, diseases, date of planting, weeding, etc.), economic factors (seed cotton price, returns to labor, etc.), social factors (grouping of fields, communal labor, labor for the chief of the village, etc.) and administrative factors (crop requirements, determination of location and size of fields by agricultural monitors, etc.).

Method of Analysis

We have chosen a multiple linear regression equation of the following form for the explanation of the variation in yields between farms:

$$Y_i = \beta_1 + \beta_2 x_{i2} +, \ldots, + \beta_m x_{im} + \beta_{m+1} x_{im+1} +, \ldots, + \beta_n x_{in} + \varepsilon_i$$

where the variables are defined as follows for farm i:

Y_i = production of seed cotton for farm i in kg. per ha.

$x_{i2}, \ldots, x_{im}$ = variables which we believe explain part of the variation in yields between farms. Data have been collected for these variables.

$x_{im+1}, \ldots, x_{in}$ = variables which we believe explain part of the variation in yields between farms, but no data were collected on these variables. Examples are soil fertility, rainfall, hours of sunshine and insect damage. Since we have no data for these variables, we assume that they remain constant between farms. They will be lumped together in the constant term of the regression equation.

ε_i = disturbance term for farm i.

The regression paramters $\beta_1, \beta_2, \ldots, \beta_m$ were estimated by the method of ordinary least squares (OLS). The usual problems with a model of this type include high degrees of multi-collinearity of the independent variables. But even with a high degree of multi-collinearity, we still get unbiased efficient estimators for the regression parameters.[1] Yet

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[1]Most simple correlations between the variables are quite small. Simple correlations larger than $|0.40|$ are between YLD and BUL, 0.49; ACO and ACC, 0.48; LAO and LAM, 0.50; DEN and LAO, 0.41; UBI and YOF, 0.42; SHL and AGE, -0.55; IPC and ROD, 0.48; UBI and CHF, -0.59; BUL and MON, -0.42; PRC and ERN, -0.52; BUL and UBI, -0.59.

another problem may arise from heteroskedasticity of the disturbance terms. If this is the case, then the OLS estimators are still unbiased but not efficient and the tests of significance are incorrect since the variances of the estimators are biased. However, testing for heteroskedasticity would lead us too far; thus, we will conveniently assume that the model is homoskedastic.[2]

The solution of the multiple linear regression equation by OLS has the following form for farm i:

$$\hat{Y}_i = \hat{\beta}_1 + \hat{\beta}_2 x_{i2} +, . . ., + \hat{\beta}_m x_{im}$$

A stepwise add and a stepwise delete OLS computer routine was used to calculate the multiple regression statistics. This routine calculates the significance probability of the F statistic for the least squares coefficients of a variable to determine whether or not it should be deleted from or added to the equation. The significance level was arbitrarily set at 0.095 for all runs. The following regression statistics are presented for each function: (1) the regression coefficient; (2) the standard error of the regression coefficient; (3) the t value of each regression coefficient; (4) significance level of each regression coefficient: this is the significance probability level of the F statistic for the OLS coefficient of a variable. It indicates the confidence level of each regression coefficient. (5) Beta weight: this is a standardized regression coefficient that measures a variable in terms of its standard error. The higher the Beta weight, the more

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[2]Weighted least squares for the heteroskedastic case make the regression equation satisfy the conditions of homoskedasticity and thus yield the best linear unbiased efficient estimators with correct tests of significance.

the variable contributes toward explaining the variability of the dependent variable. (6) R^2 delete: this indicates how much omission of the variable would reduce R^2, other things being equal. (7) partial correlation: this coefficient measures the degree of correlation between a particular independent variable and the dependent variable when all other independent variables involved are kept constant. The partial correlation coefficient differs from the simple correlation coefficient.[3] (8) simple correlation: this measures the degree of correlation between two variables when only two variables are involved. (9) R^2, the coefficient of multiple determination: this indicates the percentage of the variance in Y, the dependent variable, explained by or "associated with" the variance in the X's, the independent variables. And, (10) F value: this is the value of an F test in the analysis of variance model equivalent with the multiple regression model indicating the ratio of interaction (or treatment) mean square for the overall regression with error mean square.

In Table 8.1 we report all variables included in the multiple linear regression equation. The last three variables, UBI, MOL and BUL, are dummy variables for the Ubangi, Mongala and Bas-Uélé sub-regions, respectively.[4] These dummy variables are a proxy of all variables

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[3]The partial correlation coefficient can be written as a function of the simple correlation coefficients between the independent variables and the dependent variable and the simple correlation coefficients between the independent variables [Spiegel, 1961].

[4]We did not include a dummy variable for the Haut-Uélé sub-region to avoid matrix singularity.

Table 8.1. Yields and Acreages: Variables Included in the Multiple Linear Regression Equation

Variable	Description of the Variable
YLD[1]	Seed cotton yield in kg. per ha.
ACC	Cotton acreage per farm in ares
ACO	Acreage of other crops in ares
LAM	Labor input in man-weeks per ha. for cotton maintenance
LAO	Labor input in man-weeks per ha. for other cotton activities than maintenance
LAA	Labor units available on the farm
YOF	Years the cotton field remained in fallow
KMC	Distance cotton field-house of the farmer in km.
REP	Reasonable, equitable seed cotton price in K per kg.
DEN[1]	Cotton plant density: number of cotton plants per 9 m^2
AGE	Age of the cotton farmer
SHL	Years the cotton farmer stayed in primary school
FSA	Cotton field located in a forest (=1) or in a savannah (=0)
TPL	Planting time: June-July = 1, August = 0
IPC	Cotton growing imposition: yes = 1, no = 0
IPO	Imposition of other crops: yes = 1, no = 0
LOC	Determination of location of cotton field: by the farmer = 1, by others = 0
SIZ	Determination of size of cotton field: by the farmer = 1, by others = 0
DAY	Hiring of day-laborers: yes = 1, no = 0
MUT	Mutual work on cotton fields: yes = 1, no = 0
ROD	Obligatory work on roads: yes = 1, no = 0
CHF	Work for chiefs or other authorities: yes = 1, no = 0
MON	Knowledge of cotton monitors or territorial agronomist: yes = 1, no = 0
ERN	Cotton earned the farmer a lot of money: yes = 1, no = 0
POS	Possession of a bicycle, radio, sewing machine or watch: yes = 1, no = 0
PES[1]	Cotton fields treated with pesticides: yes = 1, no = 0
PRC	Seed cotton price influenced cotton acreage: yes = 1, no = 0
TER	Termite heaps on cotton field: yes = 1, no = 0
GRP	Cotton fields in the village are grouped: yes = 1, no = 0
UBI	Dummy variable: Ubangi = 1, other sub-regions = 0
MOL	Dummy variable: Mongala = 1, other sub-regions = 0
BUL	Dummy variable: Bas-Uélé = 1, other sub-regions = 0

[1]These variables were not included in the multiple regression equation model explaining cotton acreages per farm.

which determine cotton yields and which are typical for a sub-region but for which we lack data (the $x_{im+1}, \ldots, x_{in}$ variables).

Results of the Statistical Analysis

The results will be presented and interpreted for each sub-region in the study, for Ubangi-Mongala and the Uélés and for the entire northern cotton belt which is composed of four sub-regions. However, no results will be presented for the Mongala sub-region as only eight observations were available for this area. Thus, Ubangi-Mongala will be viewed as one sub-region.

Results for Ubangi-Mongala

Table 8.2 reports the regression statistics for the function explaining the variation in yields between farms in Ubangi-Mongala. All regression coefficients are significant at the 0.05 level of significance except for LAA (labor units available on the farm) and for TPL (time of planting) which are significant at the 0.10 level and the constant term which is only significant at the 0.15 level. We observe that the variables LAO (labor input per ha. for other cotton activities than maintenance), MON (knowledge of cotton monitors), ACC (cotton acreage per farm in ares) and KMC (distance cotton field-house in km.) contribute most toward explaining the variability of yields as their Beta weights are, respectively, 0.41, -0.33, 0.32 and 0.30. Omission of these variables reduces R^2 by, respectively, 0.10, 0.08, 0.05 and 0.05.

As indicated by the regression coefficients for MON, knowledge of a cotton monitor reduces cotton yields by 546.41 kg. per ha., other

Table 8.2. Regression Statistics for the Function YLD = fn(ACC,. . .,MON) Explaining Cotton Yields Unit of Observation: Ubangi and Mongala, Zaire, Number of Observations: 64[1]

Variable	Regression Coefficient	Standard Errors of Coefficient	T Value	Significance	Beta Weight	R^2 Deletes	Partial Correlation	Simple Correlation
Constant	302.06	206.29	1.46	.149	.00	.60	.20	---
ACC	2.74	0.91	3.03	.004	.32	.55	.38	-.00
IPO	116.03	56.51	2.05	.045	.24	.59	.27	.25
CHF	-193.87	82.47	-2.35	.022	-.25	.58	-.31	-.01
LAO	2.90	0.71	4.09	<0.0005	.41	.50	.49	.39
LAA	14.47	8.02	1.80	.077	.18	.60	.24	-.01
UBI	153.87	64.49	2.39	.021	.25	.58	.31	.33
KMC	35.53	11.27	3.15	.003	.30	.55	.40	.24
TPL	-123.53	72.04	-1.71	.092	-.20	.60	-.23	-.45
ERN	110.33	42.45	2.60	.012	.27	.57	.34	.24
MON	-546.41	145.68	-3.75	<0.0005	-.33	.52	-.46	-.29
R^2	.62							
F Value	8.61			<0.0005				

[1]Stepwise Delete

things being equal. The sign for the coefficient of TPL seems wrong, but this variable is one of the least significant. The large coefficient of the dummy variable for Ubangi sub-region (UBI), 153.87, illustrates that yields in Ubangi are distinctively higher than those in Mongala. When farmers have to work for village chiefs or other authorities (CHF), cotton yields are reduced by 193.87 kg., probably because farmers are unable to maintain or harvest their cotton field properly. Cotton imposition (IPO), on the other hand, increases yields by 116.03 kg. and, thus, constitutes a positive factor. The larger cotton acreage per farm (ACC), the higher the yields are, although the effect is weak, 2.74 kg. per are. Each additional man-week per ha. for cotton activities other than maintenance (LAO) increases yields by 2.90 kg., and the further the cotton field is from the home of the farmer (KMC), the higher yields become, an increase of 35.53 kg. per km.

For the overall regression equation, the coefficient of multiple determination (R^2) is 0.62, not particularly high, and 38 percent of the variance in yields remains unexplained.

Results for Bas-Uélé

In Bas-Uélé yields were on the average the highest (687 kg. per ha.) and they varied considerably from farm to farm (standard deviation of 453 kg.) (see Table 8.3). In applying our equation, we obtained an excellent fit as R^2 equals 0.96 (Table 8.3). The partial correlation coefficients of all the variables with yields are high as they all exceed $|0.50|$. All regression coefficients are significant at the 0.05 level except for ROD (obligatory work on roads) which is still significant at the 0.10 level. The Beta weights larger than $|0.40|$ are DEN

Table 8.3. Regression Statistics for the Function YLD = fn(ACC,. . .,LOC) Explaining Cotton Yields Unit of Observation: Bas-Uélé, Zaire, Number of Observations: 29[1]

Variable	Regression Coefficient	Standard Errors of Coefficient	T Value	Significance	Beta Weights	R^2 Deletes	Partial Correlation	Simple Correlation
Constant	-800.33	260.41	-3.07	.010	.00	.94	-.66	---
ACC	6.91	1.38	5.02	<0.0005	.41	.89	.82	.19
PRC	340.14	81.25	4.19	.001	.33	.91	.77	.23
LAM	8.41	1.96	4.29	.001	.42	.91	.78	-.07
MON	423.14	68.73	6.16	<0.0005	.42	.85	.87	.25
LAA	55.71	21.80	2.56	.025	.23	.94	.59	.45
SIZ	-499.43	134.34	-3.72	.003	-.39	.92	-.73	-.22
KMC	75.81	18.80	4.03	.002	.27	.92	.76	.38
ROD	293.58	145.75	2.01	.067	.20	.95	.50	.08
DEN	33.72	3.67	9.20	<0.0005	.56	.71	.94	.56
AGE	- 20.53	4.39	-4.67	.001	-.46	.90	-.80	-.10
POS	266.89	86.05	3.10	.009	.30	.94	.67	.19
DAY	-504.49	216.46	-2.33	.038	-.21	.95	-.56	-.12
TER	-164.15	68.55	-2.39	.034	-.18	.95	-.57	.00
CHF	-476.19	121.29	-3.93	.002	-.51	.92	-.75	.27
IPO	313.76	133.61	2.35	.037	.27	.95	.56	.30
LOC	337.29	78.11	4.32	.001	.38	.91	.78	.11
R^2	.96							
F Value	20.17			<0.0005				

[1]Stepwise Delete.

(0.56) which indicates that cotton plant density contributes most toward explaining the variation in yields; omission of this variable reduces R^2 by 0.25. Each additional cotton plant per nine square meters accounts for an increase in yields of 33.72 kg., a fact which illustrates the importance of plant densities.

Work for village chiefs or other authorities (CHF) has a strong negative effect on yields; the regression coefficient is -476.19. The Beta weight and the partial correlation coefficient are high, -0.51 and -0.75, respectively, although R^2 delete (0.92) is only slightly below R^2. Age (AGE) of the farmer also has a negative influence on yields (20.53 kg. per year); the Beta weight is equal to -0.46, the partial correlation is high, -0.80, but R^2 delete (0.90) is again close to R^2. Knowledge of a cotton monitor (MON) strongly affects yields as the regression coefficient is 423.14, positive, the Beta weight is large, 0.42, and so is the partial correlation coefficient, 0.87; R^2 delete is also 0.11 below R^2. Labor for cotton maintenance (LAM) has a high Beta weight (0.42) and partial correlation (0.78), R^2 delete is 0.91 and the coefficient is equal to 8.41, clearly not enough to dictate an increase in labor for cotton maintenance. However, we should keep in mind that labor inputs were not accurately measured. Cotton acreage per farm (ACC) has a positive and high partial correlation with yields (0.82), the Beta weight is large (0.41) and R^2 delete is equal to 0.89. Each additional are, _ceteris paribus_, increases cotton yields by 6.91 kg.

An analysis of the remaining regression coefficients is also quite revealing. The farmers who reported that seed cotton prices influenced their cotton average over time (PRC) have a yield that is on the average

340.14 kg. higher than for those who answered negatively. Determination of cotton field size by the farmer (SIZ) is associated with a lowering in yields of 499.43 kg., while remoteness of fields (KMC) has a positive effect on yields, 75.81 kg. per km., as does obligatory work on roads (ROD), 293.58, although one would normally expect a negative relationship here. This latter variable was only significant at the 0.10 level. As expected, possession of a bicycle, radio, sewing machine or watch (POS) is strongly correlated with high yields; the partial correlation is 0.67, the Beta weight is 0.30 and the coefficient is equal to 266.89. Hiring day-laborers (DAY) has a detrimental effect on yields; the coefficient is equal to -504.49. And termite heaps (TER) on a cotton field are also associated with lower yields, the coefficient being -164.15. Imposition of other crops (IPO) and determination of cotton field location by the farmer (LOC) have strong positive effects on yields, 313.76 kg. and 337.29 kg., respectively. The number of labor units available on the farm (LAA) also has a positive influence on yields, the coefficient being 55.71 kg.

Results for Haut-Uélé

Only 19 observations were available for this sub-region and the final regression equation includes 15 variables. R^2 is extremely high, 0.99, all partial correlation coefficients are also very high and all regression coefficients seem exaggerated. The results need to be analyzed with caution as not enough observations are available for a powerful statistical analysis (Table 8.4).

All regression coefficients are significant at the 0.05 level except for REP (reasonable, equitable seed cotton price) which is

Table 8.4. Regression Statistics for the Function YLD = fn(PRC,. . .,ERN) Explaining Cotton Yields Unit of Observation: Haut-Uélé, Zaire, Number of Observations: 19[1]

Variable	Regression Coefficient	Standard Errors of Coefficient	T Value	Significance	Beta Weights	R^2 Deletes	Partial Correlation	Simple Correlation
Constant	4314.06	535.61	8.05	.004	.00	.85	.98	---
PRC	- 235.68	58.30	- 4.04	.027	- .41	.96	-.92	.21
ACO	- 4.29	1.12	- 3.82	.032	- .29	.96	-.91	-.30
LAM	14.43	1.19	12.11	.001	1.66	.67	.99	.20
LAO	- 1.68	0.22	- 7.78	.004	- .94	.86	-.98	.18
LAA	173.09	26.11	6.63	.007	.66	.90	.97	-.02
YOF	- 263.65	19.98	-13.20	.001	-4.83	.62	-.99	-.21
KMC	- 194.46	26.90	- 7.23	.005	- .72	.88	-.97	.02
REP	- 45.98	17.86	- 2.57	.082	- .33	.98	-.83	-.06
POS	1617.51	107.73	15.01	.001	2.56	.50	.99	.18
AGE	- 17.37	3.83	- 4.54	.020	- .62	.95	-.93	.16
SHL	- 425.77	41.07	-10.37	.002	-2.84	.76	-.98	.13
FSA	410.95	63.01	6.52	.007	.71	.90	.97	.01
IPO	-1734.24	163.10	-10.63	.002	-2.54	.75	-.99	.28
LOC	1098.74	92.65	11.86	.001	1.74	.69	.99	-.06
ERN	1051.18	73.48	14.31	.001	1.66	.55	.99	.38
R^2	.99							
F Value	30.51			0.008				

[1]Stepwise Delete.

significant at the 0.10 level. The most important variables are years of fallow (YOF) with an unexpected negative coefficient of -263.65, Beta weight of -4.83 and R^2 delete of 0.62. The years the cotton farmer stayed in primary school (SHL) shows a strong negative effect on yields, coefficient of -425.77, Beta weight of -2.84 and R^2 delete of 0.76. However, possession of a bicycle, radio, sewing machine or watch (POS) is strongly associated with high yields as the coefficient is 1617.51, Beta weight is 2.56 and R^2 delete is 0.50. Imposition of other crops (IPO) has a very pronounced negative effect on yields, the coefficient is -1734.24, Beta weight is -2.54 and R^2 delete is 0.75, while location of the cotton field by the farmer (LOC) is strongly associated with high yields as the coefficient is 1098.74, Beta weight is 1.74 and R^2 delete is 0.69. If the farmer responds that cotton earns him a lot of money (ERN), yields are likely to be high as the coefficient is 1051.18, Beta weight is 1.66 and R^2 delete is 0.55. The effect of the remaining variables can be read from Table 8.4.

Results for Bas-Uélé and Haut-Uélé

This section combines the results for Bas-Uélé and for Haut-Uélé. A dummy variable for Bas-Uélé (BUL) was included as a proxy for factors typical of Bas-Uélé which influence cotton yields. The results are reported in Table 8.5.

The coefficient of multiple determination (R^2) is 0.68, much lower than for each one of the sub-regions separately. In fact, these two sub-regions appear as two distinct cotton production areas. Yields in Bas-Uélé were on the average much higher than those in Haut-Uélé (Table 6.22). The regression analysis confirms this as the dummy

Table 8.5. Regression Statistics for the Function YLD = fn(ACC,. . .,ERN) Explaining Cotton Yields Unit of Observation: Bas-Uélé and Haut-Uélé, Zaire, Number of Observations: 48[1]

Variable	Regression Coefficient	Standard Errors of Coefficient	T Value	Significance	Beta Weights	R^2 Deletes	Partial Correlation	Simple Correlation
Constant	-1529.94	292.50	-5.23	<0.0005	.00	.45	-.65	---
ACC	4.10	1.85	2.22	.033	.24	.64	.34	.13
IPO	213.69	124.30	1.72	.094	.26	.66	.27	.03
LOC	203.32	96.72	2.10	.042	.24	.64	.33	.12
LAO	1.00	0.39	2.53	.016	.27	.63	.38	.06
LAA	58.48	25.29	2.31	.026	.23	.64	.36	.39
MON	379.25	116.40	3.26	.002	.35	.59	.47	.09
KMC	115.31	28.24	4.08	<0.0005	.40	.54	.56	.33
BUL	538.00	133.37	4.03	<0.0005	.65	.54	.55	.30
DEN	16.95	5.66	2.99	.005	.43	.60	.44	.08
ERN	226.38	90.53	2.50	.017	.28	.63	.38	.40
R^2	.68							
F Value	7.91			<0.0005				

[1] Stepwise Delete.

variable for Bas-Uélé (BUL) emerged as the most important factor in explaining the variation in yields with a coefficient of 538.00, Beta weight of 0.65 and R^2 delete of 0.54. The other important variables were cotton plant density (DEN), already discussed for Bas-Uélé, distance cotton field-house of the farmer (KMC) which has a positive effect on yields, 115.31 kg. per km., with Beta weight of 0.40 and R^2 delete of 0.54 and knowledge of a cotton monitor (MON) which is also strongly associated with high yields as the coefficient is 379.25, Beta weight is 0.35 and R^2 delete is 0.59. Other factors which have a strong positive effect on yields are ERN (cotton earned the farmer a lot of money) with a coefficient of 226.38, IPO (imposition of other crops) with a coefficient of 213.99 and LOC (location of the cotton field by the farmer) with a coefficient of 203.32.

Results for the Northern Cotton Belt, Including Ubangi, Mongala, Bas-Uélé and Haut-Uélé

Again, the dummy variable for Bas-Uélé (BUL) is the most important factor in explaining the variation in yields (Table 8.6). The coefficient is 452.40 and Beta weight is 0.57; dropping this variable reduces R^2 by 0.23. Other variables with a Beta weight over 0.20 and which, if deleted, reduce R^2 by at least 0.04 all have a positive effect on yields. They are ERN (if cotton earned the farmer a lot of money) with a coefficient of 190.37, KMC (distance cotton field-house of farmer) with a coefficient of 56.92, DEN (cotton plant density) with a coefficient of 10.01, IPO (imposition of other crops) with a coefficient of 166.15 and LAO (labor performed for other cotton activities than maintenance) with a coefficient of 0.89. Other variables with a

Table 8.6. Regression Statistics for the Function YLD = f(ACC,. . .,ERN) Explaining Cotton Yields Unit of Observation: Northern Zaire (Ubangi, Mongala, Bas-Uélé and Haut-Uélé) Number of Observations: 112[1]

Variable	Regression Coefficient	Standard Errors	T Value	Significance	Beta Weights	R^2 Deletes	Partial Correlation	Simple Correlation
Constant	-699.24	159.52	-4.38	<0.0005	.00	.49	-.40	---
ACC	2.27	1.02	2.23	.028	.16	.55	.22	-.03
MOL	-191.75	94.69	-2.03	.045	-.14	.56	-.20	-.26
IPO	166.15	55.99	2.97	.004	.22	.54	.28	.18
LAO	0.89	0.33	2.71	.008	.21	.54	.26	.28
LAA	29.41	10.38	2.83	.006	.20	.54	.27	-.06
BUL	452.40	61.94	7.30	<0.0005	.57	.35	.59	.49
KMC	56.92	14.30	3.98	<0.0005	.27	.51	.37	.12
MON	164.04	93.51	1.75	.082	.13	.56	.17	-.11
DEN	10.01	2.98	3.36	.001	.26	.53	.32	.27
ERN	190.37	51.22	3.72	<0.0005	.27	.52	.35	.34
R^2	.58							
F Value	13.69			<0.0005				

[1]Stepwise Delete.

high coefficient but low Beta weight are MOL (dummy variable for Mongala sub-region) with a coefficient of -191.75 and Beta weight of -0.14 and LAA (labor units available on the farm) with a coefficient of 29.41 and Beta weight of 0.20.

The overall coefficient of multiple determination for the regression equation is 0.58 leaving 42 percent of the variation in yields unexplained. Thus, several important factors influencing yields in the northern cotton belt were left out of this study and could not be analyzed.

Acreages

In this section, we will first attempt to determine the price elasticity of supply (supply in terms of acreages planted), using nominal prices. We will then analyze the variation in cotton acreages between farms and between sub-regions and regions through the use of a multiple linear regression equation model and with as independent variables those listed in Table 8.1.

The Price Elasticity of Supply (Acreage Planted)

Prices in 1970 were 4.50K per kg. for first grade, 3.00K for second grade; in 1972 the prices were 6.5K for first grade and 5.00K for second grade. Since farmers in the 1972 survey were selected from a frame of cotton farmers surveyed in the 1970 Census of Agriculture in which fields were measured, it was possible to compare the cotton acreages for these farmers and to calculate the price elasticity of supply in terms of cotton acreages which we assume would be positive.

The Arc elasticity is calculated according to the following formula:

$$\text{Arc E} = \frac{S_{72} - S_{70}}{P_{72} - P_{70}} \cdot \frac{P_{72} + P_{70}}{S_{72} + S_{70}}$$

Where:

S = cotton acreage per farm in square meters

P = cotton price in K per kg., assuming 90 percent first grade and 10 percent second grade.

We assumed for convenience "all other things equal" between 1970 and 1972, in particular the prices of other agricultural products such as coffee and rice. We obtained the following results:

Sub-region	Arc E
Ubangi-Mongala	-0.086
Bas-Uélé	-1.027
Haut-Uélé	0.272
Total North	-0.309

These results do not confirm our hypothesis of a positive price elasticity of supply. Several factors may explain these results. The 1970 acreage data may be unreliable. The 1970 sample census used a sample of 16,000 farmers. Each enumerator had a heavy work schedule, and it is quite possible that measurement errors were high.[5] Yet another explanation for the poor results may be the use of nominal prices and not real prices in our elasticity calculations. It may be that the real seed cotton price did not increase. To calcuate the real 1972 seed cotton price, we deflate the nominal price with the IRES price index of 61 common consumer goods in Kinshasa [IRES, 1973]. This

[5]The 1972 acreage data were determined with great accuracy by the author and his enumerators. Several field checks were made, all fields were drawn to scale and the closing gap was less than 10 percent of the perimeter.

index had an October-December 1964 base of 100. The index was 239.0 in June 1970, and 343.3 in June 1972. Converting this index to the base of June 1970 = 100, we obtain a June 1972 index of 143.6 and a real June 1972 average seed cotton price of 4.42, about the same as the June 1970 price of 4.35. Thus, the real cotton price was practically the same in 1972 as in 1970.

Another factor which may explain the bizarre price elasticity of supply figures is that "other things were not equal." In fact, several things changed. The coffee price paid to producers did change and ONAFITEX took over the marketing operations from the private cotton companies which introduced an element of uncertainty for cotton farmers. In some areas cotton was bought late and the distribution of cotton seeds became less regular. This had an adverse effect on cotton planting. In conclusion, the available data and the quality of the data do not allow us to calculate accurate supply elasticities for cotton in terms of acreages planted.

Results of the Multiple Regression Statistical Analysis

The purpose of this section is to explain the variation in cotton acreages between farms and between sub-regions and regions through the use of the multiple linear regression equation model which was developed for the analysis of yields. The underlying hypothesis is that some of the variables which explain yield variation between farms also explain part of the acreage variation between farms. We specified the same independent variables as for the yield analysis except for those which did not make sense in explaining acreages planted (see Table 8.1).

Our approach is exploratory and unsophisticated. Time series data are needed for a proper study of the factors explaining acreages planted in a particular year, in our case 1972-1973. We do not possess such data and, thus, we will limit ourselves to an analysis of the available cross-section data.

The results are reported for sub-region, for region and for the entire North in Tables 8.7, 8.8, 8.9, 8.10 and 8.11. For all units of observation, the coefficients of multiple determination (R^2) obtained for the analysis of acreages are below those for the analysis of yields (Table 8.12).

Results for Ubangi-Mongala

Fifty-seven percent of the variance in cotton acreages per farm can be explained by five variables which are all significant at the 0.05 level. The most important one is ACO (acreage of other crops) with a Beta weight of 0.42 and a regression coefficient of 0.07 which indicate that, other things being equal, cotton acreage on the farm increases by 0.07 ares when acreage of other crops raises by one are. Moreover, cotton acreage and acreage of other crops are strongly correlated, the simple correlation being 0.60 and the partial 0.50. Omission of this variable decreases R^2 by 0.15.

Other important factors are LAO (labor inputs per ha. for other cotton activities than maintenance) with a negative coefficient of 0.24 and a Beta weight of -0.28 and R^2 delete of 0.49; CHF (work for chiefs or other authorities) which has a positive effect on cotton acreages as the coefficient is 19.89, the Beta weight is 0.22 and R^2 delete is 0.53; TER (presence of termite heaps on the cotton field) which has a

Table 8.7. Regression Statistics for the Function ACC = fn(ACO,. . .,TER) Explaining Cotton Acreages
Unit of Observation: Ubangi and Mongala, Zaire; Number of Observations: 64[1]

Variable	Regression Coefficient	Standard Errors of Coefficient	T Value	Significance	Beta Weights	R^2 Deletes	Partial Correlation	Simple Correlation
Constant	47.32	5.57	8.49	<0.0005	.00	.03	.74	---
ACO	0.07	0.02	4.40	<0.0005	.42	.42	.50	.60
LAM	- 0.23	0.11	-2.04	.046	-.18	.54	-.26	-.30
LAO	- 0.24	0.08	-3.17	.002	-.28	.49	-.38	-.39
CHF	19.89	8.54	2.33	.023	.22	.53	.29	.36
TER	9.37	4.47	2.10	.040	.19	.54	.27	.37
R^2	.57							
F Value	15.26			<0.0005				

[1]Stepwise Delete or Stepwise Add

Table 8.8. Regression Statistics for the Function ACC = fn(CHF,. . .,SHL) Explaining Cotton Acreages Unit of Observation: Bas-Uélé, Zaire; Number of Observations: 29[1]

Variable	Regression Coefficient	Standard Errors of Coefficient	T Value	Significance	Beta Weights	R^2 Deletes	Partial Correlation	Simple Correlation
Constant	13.45	14.20	.95	.354	.00	.73	.20	---
CHF	15.87	6.96	2.28	.033	.29	.68	.44	.19
ROD	-43.39	12.19	-3.56	.002	-.50	.59	-.60	-.06
LAO	- 0.18	0.06	-3.26	.004	-.38	.61	-.57	-.34
IPC	34.35	9.12	3.76	.001	.49	.57	.63	.22
YOF	3.73	0.71	5.22	<0.0005	.59	.41	.74	.57
SHL	3.58	1.89	1.90	.071	.24	.70	.38	.33
R^2	.74							
F Value	10.36			<0.0005				

[1] Stepwise Delete

Table 8.9. Regression Statistics for the Function ACC = fn(IPO,. . .,YOF) Explaining Cotton Acreages Unit of Observation: Haut-Uélé, Zaire; Number of Observations: 19[1]

Variable	Regression Coefficient	Standard Errors of Coefficient	T Value	Significance	Beta Weights	R^2 Deletes	Partial Correlation	Simple Correlation
Constant	-13.50	18.89	-0.71	.437	.00	.67	-.19	---
IPO	29.08	12.74	2.28	.040	.62	.56	.53	.02
LAM	- 0.40	0.10	-4.10	.001	-.68	.28	-.75	-.51
PRC	26.68	7.97	3.35	.005	.68	.42	.68	.39
POS	-18.18	7.57	-2.40	.032	-.42	.55	-.55	-.33
YOF	3.40	1.16	2.92	.012	.92	.48	.63	-.09
R^2	.69							
F Value	5.71			.005				

[1]Stepwise Delete

Table 8.10. Regression Statistics for the Function ACC = fn(CHF,. . .,IPC) Explaining Cotton Acreages
Unit of Observation: Bas-Uélé and Haut-Uélé, Zaire; Number of Observations: 48[1]

Variable	Regression Coefficient	Standard Errors of Coefficient	T Value	Significance	Beta Weights	R^2 Deletes	Partial Correlation	Simple Correlation
Constant	26.21	13.71	1.91	.063	.00	.47	.29	---
CHF	15.26	7.44	2.05	.047	.27	.47	.31	.10
LAM	- 0.27	0.13	-2.13	.039	-.31	.46	-.32	-.44
LAO	- 0.06	0.03	-2.04	.048	-.29	.47	-.31	-.39
ROD	-35.23	13.62	-2.59	.013	-.36	.44	-.38	-.08
YOF	2.27	0.59	3.83	<0.0005	.43	.34	.52	.33
SHL	2.82	1.57	1.80	.080	.21	.48	.27	.17
IPC	21.16	10.71	1.98	.055	.27	.47	.30	.13
R^2	.52							
F Value	6.16			<0.0005				

[1]Stepwise Delete

Table 8.11. Regression Statistics for the Function ACC = fn(ACO,. . .,TER) Explaining Cotton Acreages Unit of Observation: Northern Zaire (Ubangi, Mongala, Bas-Uélé and Haut-Uélé); Number of Observations: 112[1]

Variable	Regression Coefficient	Standard Errors of Coefficient	T Value	Significance	Beta Weights	R^2 Deletes	Partial Correlation	Simple Correlation
Constant	15.80	7.31	2.16	.033	.00	.48	.21	---
ACO	0.08	0.02	4.79	<0.0005	.36	.39	.43	.48
LAM	- 0.25	0.09	-2.95	.004	-.24	.46	-.28	-.40
LAO	- 0.08	0.03	-2.94	.004	-.26	.46	-.28	-.37
CHF	13.77	5.25	2.62	.010	.27	.47	.25	.01
YOF	2.14	0.55	3.92	<0.0005	.31	.42	.36	.12
MOL	15.57	8.50	1.83	.070	.16	.48	.18	.09
UBI	12.58	5.82	2.16	.033	.25	.48	.21	.15
TER	8.11	3.83	2.12	.036	.15	.48	.20	.28
R^2	.50							
F Value	12.81			<0.0005				

[1]Stepwise Delete

strong positive relation to cotton acreage, the coefficient being 9.37, the Beta weight 0.19 and R^2 delete 0.54 and, finally, LAM (labor for cotton maintenance) which has a negative effect on cotton acreage with the coefficient equal to -0.23, Beta weight -0.18 and R^2 delete 0.54.

Results for Bas-Uélé

We obtained a good fit: R^2 is equal to 0.74 and all variables are significant at the 0.05 level except SHL (number of years in school) which is significant at the 0.10 level of significance and the constant term which is only significant at the 0.35 level.

By far the most important factor is the number of years the cotton field remained in fallow (YOF). The Beta weight here is 0.59, and deleting this variable reduces R^2 by 0.33. The regression coefficient is equal to 3.73. The next two important variables are ROD (obligatory work on roads) and IPC (cotton growing imposition) with Beta weights of -0.50 and 0.49 and R^2 deletes of 0.59 and 0.57, respectively. Road work has a negative effect on cotton acreages--the coefficient is 43.39, while cotton imposition shows a positive influence with a coefficient of 34.35. Other important factors are LAO (labor for cotton activities other than maintenance) with a coefficient of -0.18, CHF (work for chief and other authorities) with a positive effect, coefficient of 15.87, and the number of years in primary school (SHL) with a coefficient of 3.58.

Results for Haut-Uélé

Only 19 observations were available for Haut-Uélé and thus, the results should be interpreted with caution. The coefficient of multiple determination (R^2) is high (0.69), and all variables are significant at the 0.05 level except for the constant term which is only significant at the 0.48 level. The partial correlation coefficients of the variables are also all high, above |0.50|.

As was the case for Base-Uélé, the factor which explains most of the variation in cotton acreages is the number of years the cotton field remained in fallow (YOF). The Beta weight is 0.92 and omission of this variable reduces R^2 by 0.21. The regression coefficient is equal to 3.40, about the same as that for Bas-Uélé (3.73). The variable which reduces R^2 the most when deleted is LAM (labor input for cotton maintenance) with R^2 delete equal to 0.28. This factor has also the highest absolute partial correlation coefficient with cotton acreages, |-0.75|; the Beta weight is equal to 0.68 and the coefficient to -0.40. Other important factors are PRC (the seed cotton price influenced cotton acreage) with a Beta weight of 0.68, R^2 delete of 0.42 and a coefficient of 26.68; IPO (imposition of other crops) with a Beta weight of 0.62, R^2 delete of 0.56 and a coefficient of 29.08 and POS (possession of a bicycle, radio, sewing machine or watch) with a Beta weight of -0.42, R^2 delete of 0.55 and a coefficient of -18.18.

Results for Bas-Uélé and Haut-Uélé

The regression equation explains 52 percent of the variation in cotton acreages. All the variables included in the regression are significant at the 0.05 level except for the constant terms, SHL (number of years in primary school) and IPC (cotton imposition), which are significant at the 0.10 level of confidence. The partial correlation coefficients of the variables with cotton acreages are relatively low except for YOF (years of fallow) [0.52] and ROD (obligatory work on roads) [-0.38].

As can be expected from our discussion of the results for Bas-Uélé and Haut-Uélé, YOF is the variable which explains most of the variation in cotton acreages for the Uélés. The longer fields remain in fallow, the larger are cotton acreages per farm, although the effect is weak, 2.27 ares per year in fallow, ceteris paribus. The Beta weight is equal to 0.43 and deleting this variable reduces R^2 by 0.18. ROD (obligatory work on roads) is the second most important variable with a Beta weight of -0.36, R^2 delete of 0.44 and a coefficient of -35.23. Clearly, then, work on roads reduces the acreage planted in cotton. The next two most important variables are labor input in cotton production: labor for cotton maintenance (LAM) with a Beta weight of -0.31 and R^2 delete of 0.46 and labor for other cotton activities (LAO) with a Beta weight of -0.29 and R^2 delete of 0.47. The more labor input per hectare of cotton, the smaller the cotton acreages are. The greatest effect is for labor in cotton maintenance with a coefficient of -0.27; labor for other cotton activities has a coefficient of only -0.06.

Variables of lesser importance are CHF (work for chiefs or other authorities) which has a positive effect on cotton acreages (coefficient: 15.26, Beta weight: 0.27 and R^2 delete: 0.47); IPC (cotton imposition) which has a strong positive influence on cotton acreages (coefficient: 21.16, Beta weight: 0.27, R^2 delete: 0.47) and SHL (years the cotton farmer stayed in primary school) which has a small positive effect on cotton acreages (coefficient: 2.82, Beta weight: 0.21, R^2 delete: 0.48).

Results for the Northern Cotton Belt Including Ubangi, Mongala, Bas-Uélé and Haut-Uélé

Our linear multiple regression model explains just half of the variance in cotton acreages in terms of the variance of eight other variables ($R^2 = 0.50$). All variables included in the equation are significant at the 0.05 level of significance, except the dummy variable for Mongala (MOL) which is still significant at the 0.10 level. The partial correlation coefficients are generally low, except for the two most important variables, ACO (acreage of other crops: 0.43) and YOF (years in fallow: 0.36).

The major differences between sub-regions are reflected in the inclusion of two dummy variables for sub-regions in the equation: UBI (for Ubangi) with a Beta weight of 0.25, R^2 delete of 0.48 and coefficient of 12.58 and MOL (for Mongala) with corresponding values of 0.16, 0.48 and 15.57.

ACO and YOF are the two most important variables. As we have already pointed out, ACO (Beta weight: 0.36, R^2 delete: 0.39 and coefficient: 0.08) is the most important variable in Ubangi-Mongala and YOF (Beta weight: 0.31, R^2 delete: 0.42 and coefficient: 2.14) in the Uélés. Other variables with a positive effect on cotton acreages are CHF (work for chiefs or other authorities) with a Beta weight of 0.27, R^2 delete of 0.47 and coefficient of 13.77 and TER (presence of termite heaps on cotton fields) with a Beta weight of 0.15, R^2 delete of 0.48 and coefficient of 8.11. Variables with a negative influence on cotton acreages are the labor inputs per hectare in cotton production: LAM (labor for cotton maintenance) with a Beta weight of -0.24,

R^2 delete of 0.46 and coefficient of -0.25 and LAO (labor for other cotton production activities) with a Beta weight of -0.26, R^2 delete of 0.46 and coefficient of -0.08. Thus, the labor input for cotton maintenance has a stronger negative effect on cotton acreages (coefficient: -0.25) than the labor input for the other cotton activities (coefficient: -0.08).

Table 8.12. Republic of Zaire: Comparison of the Coefficients of Multiple Determination (R^2) Obtained in the Analysis of Cotton Yields and in the Analysis of Cotton Acreages per Farm[1]

Sub-regions	Analysis of Cotton Yields	Analysis of Cotton Acreages
Ubangi and Mongala	0.62	0.57
Bas-Uélé	0.96	0.74
Haut-Uélé	0.99	0.69
Bas-Uélé and Haut-Uélé	0.68	0.52
Ubangi, Mongala, Bas-Uélé and Haut-Uélé	0.58	0.50

[1]The same significance level of the F-statistic was specified for the study of acreages as for the study of yields, namely 0.095.

Cotton Production

Production is determined by total acreages planted and average yield per unit of acreage. These elements have been analyzed in the previous sections. In this section we will concentrate on a comparison of the determinants of cotton production (number of cotton farmers, acreage per farm and yield in kg. per hectare and in kg. per farm) for 1958-1959 when production was at its peak, for 1970-71 using government statistics and for 1972-1973 using the farm business survey data.

Comparison of Cotton Production Determinants Between 1958-1959 and 1970-1971[6]

Production in 1973 was 45.1 percent of the 1959 level; in 1971 it was 31.8 percent. The purpose of this analysis is to identify why cotton production declined over the 1958/1959-1970/1971 period. The characteristics per zone in the northern belt for 1958-1959 and 1970-1971 are found in Tables 8.13 and 8.14 using official government statistics. Table 8.15 presents the production of seed cotton in northern Zaire in 1958-1959, 1970-1971 and 1972-1973. The change in the determinants of cotton production between 1958-1959 and 1970-1971 in percent of the 1958-1959 figures for the Equator region are given in Table 8.16.

For Ubangi production was at the 1959 level, but the increase in the number of cotton farmers and in total acreage was completely offset by a large decrease (26.6 percent) in yields per farm in kg. per hectare.

For Mongala the large drop in production (68.0 percent) was due to three factors: a decrease in the number of cotton farmers, a large decrease in the acreage per farm and an even larger decrease in yields per farm in kg. per hectare. For the Equator region production was 28.1 percent below the 1959 level because of this large drop in production in Mongala sub-region. A decrease in yields per farm in kg. per hectare accounted for most of the Equator regions drop in production.

Table 8.17 provides the same information for the Haut Zaire region. The Ituri and Tshopo sub-regions are also included although they were

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[6]We could not use 1972 data as 1971-1972 was an abnormal cotton production year. Lack of rains in October 1971 and major insect attacks caused a sharp drop in cotton production in Ubangi. The 1973 data was not yet available for analysis when this study was completed.

Table 8.13. Characteristics of Cotton Production in Northern Zaire per Zone, 1958-1959 and 1970-1971[1]

Regions, Sub-Regions and Zones	Number of Cotton Farmers		Acreage in Hectares		Production of Seed Cotton in Tons	
	1958-1959	1970-1971	1958-1959	1970-1971	1958-1959	1970-1971
Equator Region:	112,047	124,685	43,294	48,133	18,003	12,948
-Ubangi						
Gemena	25,130	34,987	8,917	14,910	4,526	3,913
Libenge	13,580	11,018	4,650	4,462	1,148	983
Bosobolo	16,228	21,467	7,445	9,813	2,309	3,391
Budjala	9,057	7,240	3,170	3,326	1,474	940
Kungu	7,478	12,702	2,560	3,761	1,187	1,363
Total:	71,473	87,414	26,742	36,272	10,644	10,590
-Mongala						
Mobaye (Banzyville)	18,166	14,392	7,658	4,927	3,213	819
Businga	14,549	15,541	5,379	5,099	2,045	1,178
Bumba	7,254	7,338	3,264	1,835	1,989	361
Lisala	605	0	251	0	113	0
Total:	40,574	37,271	16,552	11,861	7,359	2,358
Haut-Zaire Region:	227,391	149,906	103,123	40,276	55,754	10,489
-Bas-Uele						
Aketi	13,202	8,846	6,198	2,533	4,016	550
Ango	18,129	11,879	6,618	3,023	4,064	1,153
Bambesa	13,081	6,960	11,187	3,879	8,643	1,849
Buta	7,990	4,799	4,319	1,586	2,911	396
Poko	23,206	11,038	10,903	3,046	5,647	974
Bondo	22,805	15,980	9,758	4,322	5,457	1,945
Total:	98,413	59,502	48,983	18,392	30,738	6,867
-Haut-Uele						
Dungu	37,924	27,064	19,777	5,671	7,956	1,143
Isiro	21,451	11,884	7,823	3,266	2,924	738
Wamba	25,920	18,595	10,165	4,521	4,615	1,083
Niangara	13,687	6,776	4,469	3,860	1,455	106
Faradje	---	3,426	---	451	---	45
Watsa	---	546	---	134	---	21
Total:	98,982	68,291	42,234	17,903	16,950	3,134
-Ituri						
Mahagi	10,445	16,977	4,067	2,467	3,456	130
Total:	10,445	16,977	4,067	2,467	3,456	130
-Tshopo						
Bafwasende	9,686	---	3,878	---	2,275	---
Banalia	9,865	5,136	3,961	1,514	2,335	358
Total:	19,551	5,136	7,839	1,514	4,610	358
Total North	339,438	274,591	146,417	88,409	73,757	23,437

[1]République du Zaire, Avril 1972. Projet de Relance Cotonnière dans la Province de l'Equateur. Kanshasa: Ministére de l'Agriculture, annexe 12 for the 1958-1959 figures and République du Zaire, Rapport Annuel, Service Provincial de l'Agriculture, Province de l'Equateur, 1971 and Province du Haut-Zaire, 1972 for the 1970-1971 figures.

Note: It is doubtful whether the 1958-1959 and 1970-1971 statistics are accurate. The number of cotton farmers is probably fairly accurate as an enumeration of all cotton farmers is regularly carried out by agricultural officers and extension agents. We believe that the production figures are accurate as they are derived from the seed cotton purchase figures of the cotton companies. However, we seriously question the accuracy of acreage figures as most territorial agronomists and cotton extension agents responsible for the collection of this data do not measure the fields accurately. Thus, acreage figures should be considered as rough guestimates. As a consequence, yields derived from the production and acreage data are also a guesttimate, but yields in kg. per farm are probably fairly accurate.

Table 8.14. Characteristics of Cotton Production in Northern Zaire per Zone, 1958-1959 and 1970-1971[1]

Regions, Sub-Regions and Zones	Yield (kg./ha.)		Yield (kg. per farm)		Acreage per Farm in Ares	
	1958-1959	1970-1971	1958-1959	1970-1971	1958-1959	1970-1971
Equator Region:	416	270	161	104	39	39
-Ubangi						
Gemena	508	262	180	112	35	43
Libenge	246	220	85	89	34	40
Bosobolo	310	345	142	158	46	46
Budjala	465	283	163	130	35	46
Kungu	464	362	159	107	34	30
Total:	398	292	149	121	37	41
-Mongala						
Mobaye (Banzyville)	419	166	177	57	42	34
Businga	379	231	141	76	37	33
Bumba	609	196	274	49	45	25
Lisala	445	0	187	0	41	0
Total:	445	199	181	63	41	32
Haut-Zaire Region:	540	260	245	70	45	27
-Bas-Uele						
Aketi	648	617	304	62	47	29
Ango	614	381	224	97	37	25
Bambesa	773	476	661	266	86	56
Buta	674	250	364	83	54	33
Poko	618	320	243	88	47	28
Bondo	559	450	239	122	43	27
Total:	628	373	312	115	50	31
-Haut-Uele						
Dungu	405	206	210	42	52	21
Isiro	373	226	136	62	36	27
Wamba	453	239	178	58	39	24
Niangara	325	27	106	16	33	57
Faradje	---	100	---	13	0	13
Watsa	---	157	---	38	0	25
Total:	401	108	171	46	43	26
-Ituri						
Mahagi	850	53	331	8	39	15
Total:	850	53	331	8	39	15
-Ishopo						
Bafwasende	586	---	235	---	40	0
Banalia	589	236	237	70	40	29
Total:	588	236	236	70	40	29
Total North	504	265	217	85	43	32

[1] Derived from Table 8.13.

Table 8.15. **Production of Seed Cotton in Northern Zaire in 1958-1959, 1970-1971 and 1972-1973**[1]

Regions and Sub-Regions	1958-1959	1970-1971	1972-1973
	------------Tons------------		
Equator Region	18,003	12,948	12,709
Ubangi	10,644	10,590	9,573
Mongala	7,359	2,358	3,136
Haut Zaire Region	55,754	10,489	19,075[2]
Bas-Uélé	30,738	6,867	10,440
Haut-Uélé	16,950	3,134	7,621
Ituri	3,456	130	1,456
Tshopo	4,610	358	560

[1] From Table 8.13; for the 1972-1973 data, for Equator Region: République du Zaire, 1974, Rapport Annuel 1973, Région de l'Equateur, Division Régionale de l'Agriculture; for the 1971-1972 data for Haut Zaire Region: République du Zaire, 1973 (a) Rapport Annuel 1972, Région du Haut Zaire, Kinshasa: Division de l'Agriculture.

[2] The data for Haut Zaire are for 1971-1972 as the 1972-1973 data were not available per sub-region. The 1972-1973 seed cotton production for Haut Zaire was estimated at 21,178 tons.

Table 8.16. Change in Cotton Production Determinants Between 1958-1959 and 1970-1971 for Equator Region, Zaire (Change in Percentage of the 1958-1959 Figures)

Cotton Production Determinants	Ubangi Sub-Region	Mongala Sub-Region	Equator Region
No. of Cotton Farmers	+22.3	- 8.1	+11.3
Total Acreage	+35.6	-28.3	+11.2
Acreage per Farm	+10.8	-22.0	no change
Production	- 0.5	-68.0	-28.1
Yields in kg./ha.	-26.6	-55.3	-35.1
Yield per Farm in kg.	-18.8	-65.2	-35.4

[1]Derived from Tables 8.13 and 8.14.

not part of the farm business survey. Both sub-regions are of lesser importance as compared with the Uélés. In Bas-Uélé the number of cotton farmers, the average acreage per farm and the yield per farm in kg. per ha. decreased about 40 percent, and account for the large drop in cotton production, 77.7 percent. For Haut-Uélé the same picture is repeated, but the reduction in yields per farm in kg. per ha. is much larger, 73.1 percent. Production there dropped 81.5 percent. For Ituri and Tshopo production declined more than 90 percent because of the combined effects of a decrease in acreage per farm, yield per farm in kg. per ha. and number of farmers (except for Ituri). In summary, for the Haut Zaire region the number of cotton farmers, acreages per farm and yields per farm each declined more than 30 percent and the production was less than 80 percent of the 1959 level. The single most important factor responsible for this decline was the decrease in yields per farm in kg. per ha.

Table 8.17. Change in Cotton Production Determinants Between 1958-1959 and 1970-1971 for Haut Zaire Sub-Regions and the Entire Region (Change in Percentage of the 1958-1959 Figures)

Cotton Production Determinants	Bas-Uélé Sub-Region	Haut-Uélé Sub-Region	Ituri Sub-Region	Tshopo Sub-Region	Haut Zaire Region
No. of Cotton Farmers	-39.5	-31.0	+62.5	-73.7	-34.1
Total Acreage	-62.5	-57.6	-39.3	-80.7	-60.9
Acreage per Farm	-38.0	-39.5	-61.5	-27.5	-40.0
Production	-77.7	-81.5	-96.2	-92.2	-81.2
Yield in kg./ha.	-40.6	-73.1	-93.8	-59.9	-51.9
Yield per farm in kg.	-63.1	-73.1	-97.6	-70.3	-71.4

[1] Derived from Tables 8.13 and 8.14.

Comparison Between the Official Government Statistics for 1970-1971 and the Farm Business Survey Data for 1972-1973

The cotton production parameters derived in the farm business survey could not be compared with the official 1972-1973 data as the 1973 agricultural report of Equator region did not contain the desired data and the 1973 report for Haut Zaire region was not yet available in July 1974 when the author left Zaire. The 1971-1972 data were "abnormal" because of the October draught in Ubangi and massive insect damage to cotton. Thus, we will compare the survey data with the official 1970-1971 data (Tables 8.13 and 8.14).

The cotton production determinants for Ubangi-Mongala are almost identical for 1970-1971 and 1972-1973 (Table 8.18). For the Uélés the acreage data is comparable, but there are marked differences in yields, in terms of kg. per ha. and kg. per farm (Table 8.18). Yields in 1972-1973 were more than double the yields in 1970-1971. The number of cotton farmers per sub-region could not be estimated in the 1972-1973 farm business survey.

If we accept the 1972-1973 farm business survey data for the Uélés, then the implications for our analysis of the reasons why cotton production in northern Zaire in the 1970s was low are:

--yields in kg. per ha. for the Uélés in 1973 were at the 1959 level (somewhat higher for Bas-Uélé, somewhat lower for Haut-Uélé) (Table 8.19). This contrasts with the official 1971 data which showed a sharp decline since 1959.

--acreage per farm (Table 8.19) dropped in Bas-Uélé (down 34 percent) and in Haut-Uélé (down 42 percent) at about the same rate as for the official 1970-1971 data.

Table 8.18. Northern Zaire: Comparison Between Cotton Production Determinants for 1970-1971 (Official Data) and 1972-1973 (Farm Business Survey Data)[1]

Cotton Production Determinants	Ubangi-Mongala		Bas-Uélé		Haut-Uélé		Total Northern Zaire	
	1970-1971	1972-1973	1970-1971	1972-1973	1970-1971	1972-1973	1970-1971	1972-1973
Acreage per farm in ares	39	40	31	33	26	25	32	36
Yield in kg. per ha.	270	257	373	753	108	376	265	391
Yield per farm in kg.	104	103	115	250	46	94	85	140

[1]Data derived from Tables 8.13 and 8.14.

Table 8.19. Comparison Between Cotton Production Determinants for 1958-1959 (Official Data)and 1972-1973 (Farm Business Survey Data) for the Uélés and for Northern Zaire

Cotton Production Determinants	Bas-Uélé		Haut-Uélé		Total Northern Zaire	
	1958-1959	1972-1973	1958-1959	1972-1973	1958-1959	1972-1973
Acreage per farm in ares	50	33	43	25	43	36
Yield in kg. per ha.	628	753	401	376	504	391
Yield per farm in kg.	312	250	171	94	217	140

[1]From Table 8.14 and Table 6.22.

--yields per farm in kg. (Table 8.19) dropped in Bas-Uélé (down 20 percent) and in Haut-Uélé (down 45 percent) but much less than in the official 1970-1971 data.

Thus, according to the 1972-1973 farm business survey data, the low level of cotton production in the Uélés relative to 1959 can be explained not in terms of yields in kg. per ha., but because of a decrease in acreage per farm and a large decrease in the number of cotton farmers.

Cotton production has increased rapidly since 1971 in Haut Zaire region. Production is now around 20,000 tons of seed cotton (see Tables 3.11 and 8.15) but, it is not known which factors account for this increase although, probably, the combined effects of an increase in yields, particularly since the introduction of a new seed variety (Reba B 50), and an increase in the number of cotton farmers since the raise in seed cotton prices in 1972 brought about the increase in production.

Summary

A multiple linear regression equation model was used to explain the variation in yields between farms. For the northern cotton belt a coefficient of multiple determination (R^2) of 0.58 was obtained and the dummy variable for Bas-Uélé turned out to be the most important factor. Other important variables with a positive effect were cotton revenues, the distance from the house to the field, cotton plant density, imposition of other crops than cotton, labor performed on other cotton activities than maintenance and labor units available on the farm.

In the analysis of factors explaining acreages, an attempt was made to determine the price elasticity of supply in terms of acreages planted. The results do not confirm our hypothesis of a positive nominal price effect. The following factors probably influenced the unexpected outcome of our supply response analysis: the real cotton price remained almost constant over the 1970-1972 period, the 1970 acreage data could have been inaccurate and other things may not have remained equal over the time period considered.

The variations in cotton acreages between farms were analyzed with a linear multiple regression technique and one-half of the variance in cotton acreages was explained in terms of the variance of eight other variables for the North ($R^2 = 0.50$). Two dummy variables were included in the equation, one for Ubangi and one for Mongala, reflecting the major differences between sub-regions. The most important variables were acreage in other crops, particularly in Ubangi-Mongala, and years of fallow, particularly in the Uélés. Both variables had a positive effect on cotton acreages. Another variable with a positive effect was work for chiefs and other authorities. Variables with a negative influence were the labor inputs per hectare in cotton production with labor for cotton maintenance having a stronger negative effect than labor for other cotton activities.

A comparison of the cotton production determinants between 1958-1959 and 1970-1971 revealed that production in 1971 in Ubangi was at the 1959 level but that the increase in the number of cotton farmers and in total acreage were offset by a large decrease in yields per farm in kg. per ha. For Mongala, production dropped 68 percent as a result of a decrease in the number of cotton farmers, a large decrease in acreage per farm and an even larger decrease in yields per farm in kg. per hectare. In Bas-Uélé the number of cotton farmers, the average acreage per farm and the yield per farm in kg. per hectare decreased all in the same degree, about 40 percent,and accounted for the large drop in production, 77.7 percent. In Haut-Uélé the same picture was repeated but the decline in yields was much larger, 73.1 percent,while production fell by 81.5 percent.

A comparison between the cotton production determinants derived in the 1972-1973 farm business survey and the 1970-1971 official data yielded almost identical data for Ubangi-Mongala but marked differences for the Uélés, except for the acreage data. Yields in kg. per hectare for the Uélés in 1973 were at the 1959 level, somewhat higher for Bas-Uélé and somewhat lower for Haut-Uélé. This contrasts with the official 1971 data which showed a sharp decline in yields since 1959. As a result, this author questions the 1970-1971 yield data for the Uélés. According to the 1972-1973 farm business survey data,the low level of cotton production relative to 1959 can be explained only in terms of a decrease in acreage per farm and a large decrease in the number of cotton farmers in the Uélés.

CHAPTER IX

STRATEGIES FOR INCREASING COTTON PRODUCTION IN NORTHERN ZAIRE

Introduction

The purpose of this study is to understand the functioning of the cotton subsector in northern Zaire, to identify barriers to improved performance, including production and marketing performance,and to formulate policy prescriptions for improving the performance of the subsector .

In the previous chapters, we have described the cotton subsector in northern Zaire and we have identified a number of important barriers to improving the performance of the subsector. These barriers are diagnostic analytical statements about the performance of the subsector. They are discussed in the next section. We will then analyze alternative strategies for expanding cotton production in northern Zaire within the overall political strategies for developing northern Zaire. In the final chapter, we will advance systematic policy prescriptions for increasing cotton production and for improving the performance of the cotton subsector in northern Zaire.

Barriers to Improving the Performance of the Cotton Subsector in Northern Zaire

Under present pricing policies

—Cotton is not profitable for most farmers in the North relative to coffee and some food crops (rice, maize). The real price of seed cotton is now about half the 1960 price.

--Cotton producer prices are uniform throughout Zaire resulting in allocative inefficiencies, a dispersion of cotton production and high per unit assembly and transport costs.

--Cotton lint is presently being sold to domestic spinners at a price well below the export price.

--Cotton growing imposition is still widespread in the North; the location and the size of cotton fields are largely determined by cotton extension agents and to a lesser extent, the territorial agronomist and village or clan authorities. The cotton extension service performs the role of a regulatory agency.

--The cotton extension service is uncoordinated, poorly trained and largely ineffective in educating farmers.

--Recommended agronomic practices are not followed by the majority of the cotton farmers. Seed cotton yields are low--an average of 399 kg. per ha., while experiment stations in the North easily obtain 1,000 to 1,500 kg. per ha., without using chemical fertilizers.

--Improved inputs such as chemical fertilizers, pesticides, credit and mechanization are not used by the farmers and there is almost no information on the economics of using these inputs at the farm level.

--The present cotton variety in the North is degenerating; no significant cotton breeding and cotton selection is underway to northern Zaire.

--Farmers lack information on the seed cotton price, time of collection and weight of their crop.

--Per unit cotton marketing and processing costs are very high.

--Seed cotton collection starts too late and is spread over an extended period of time.

--Seed cotton collection is inefficient in terms of total collection per day and per collection team.

--Transport costs are high because of the long distances involved and poor condition of the roads.

--Cotton lint is charged the most expensive fare category of all agricultural products transported by public and semi-public transporters.

--The coordination of cotton marketing and processing operations is weak.

--Ginning costs are high because of underutilization of available ginning capacity and poor organization of processing operations.

--New ginning equipment is being installed which will result in an even larger underutilization of the available ginning capacity.

Based on the diagnosis of these different barriers on improved performance, we will now analyze a number of different strategies for overcoming these barriers. We will first show that these strategies must be viewed within an overall political economy framework for developing rural areas in northern Zaire.

Strategies for Developing Northern Zaire

Northern Zaire is an agrarian dominated region. The government of Zaire has now committed itself to develop the North, based on industrial development of the third growth pole centered in Kisangani and the development of rural areas. In fact, the southern part of the country is leading the country through expansion of the mining industry and the development of the major food crop subsectors, particularly maize, but also the cotton and livestock subsectors. The Zaire government favors a balanced growth of all the regions according to their natural resource endowments. However, a comprehensive strategy for developing the North has not yet been announced although baseline studies have been completed or are underway by private firms.

One of the main problems of developing the North is the government's adherence to uniform pricing policies for most agricultural products. These policies result in low production densities, and, as a consequence, high assembly and transport costs, lack of regional specialization and lack of an adequate infrastructure in areas with a comparative advantage for the development of a particular subsector. Thus, there are substantial real economic costs involved in maintaining uniform prices on social-political grounds. This problem will be discussed in the next section.

Strategies for developing northern Zaire will require pilot development projects and policy guidelines to move towards regional specialization of farming systems. Major shifts in location of agricultural production are likely to occur with improved transport and communications and with producer prices based on comparative advantage.

Until more research on farming systems in the North is completed, it will be difficult to indicate the areas for regional specialization and to identify viable pilot development projects for the crops other than cotton. This cotton research will serve as a model for undertaking studies on other commodities to assist policy makers in furthering our understanding of potential regional specialization of production in northern Zaire.

Strategies for Expanding Cotton Production in Northern Zaire

The first priority for improving the performance of the total cotton subsector in Northern Zaire is to expand cotton production within a framework of regional specialization in order to reduce assembly and transport costs and to utilize the excess ginning capacity.

There is a colonial legacy in Zaire of assuming that farmers are unresponsive to production incentives, to new technologies of production and to economic opportunities. This is reflected in low producer prices paid to farmers, in requiring farmers to grow certain crops and to observe certain agronomic practices and in treating the farmers' fields with pesticides. Instead of performing an educational role, the cotton extension service played the role of a regulatory agency during the colonial period and it is still playing this role today.

This author's field research has clearly shown that farmers do respond to production incentives and economic opportunities and, therefore, strategies for expanding cotton production need to focus on improving the incentives for small farmers. These strategies should provide cotton farmers with improved production incentives, extension education for improving cotton yields and for expanding acreage per farm.

Revising Pricing Policies and Removing the Imposition System

Cotton farmers definitely need stronger incentives to increase cotton production. Our field research showed that small price changes will have little effect and, thus, a substantial increase is called for. Farmers will also adjust their production rather slowly to modest changes in producer prices. A substantial increase in the seed cotton price will stimulate cotton production and will speed up the diffusion of innovations, the absorption of new inputs and the utilization of idle processing capacity.

A substantial increase in the seed cotton price will reduce the need for the imposition system as farmers will be motivated to produce cotton without compulsion. By itself, the imposition system does no harm but it has a high administrative cost as it detracts extension agents from their primary role which is the education of farmers. Thus, an increased producer price will allow the imposition system to be removed and will free cotton extension agents from regulatory tasks. When cotton production becomes profitable, farmers will also be interested in protecting their crop from insects and pests. Thus, the government should drop spraying and dusting the farmers' fields and instead should concentrate on teaching farmers how to treat their fields with pesticides.

The price increase could be both in cash and in kind. For example, many farmers cannot acquire small farm tools in their community and they could be made available at subsidized rates.

Since coffee production already exceeds Zaire's quota, there are sound arguments for increasing the export duty on coffee and channeling part of this additional revenue into crop diversification in the major coffee growing areas of the North where cotton could replace some excess coffee production. However, as long as the returns to labor in coffee production are well above those for cotton, government attempts to replace coffee with cotton will be futile. Hence, a substantial increase in the seed cotton price is needed to encourage farmers to shift from coffee into cotton production.

In terms of economic efficiency, uniform pricing--paying all farmers the same producer price--should be abandoned. A shift to variable producer prices based on transport costs would induce a concentration of cotton production in a few areas and would substantially reduce per unit assembly, transport and ginning costs. Pilot cotton development projects could then be located in the areas with natural resource endowments favorable to cotton. However, regional pricing policies are probably unacceptable to the Zairean government for political reasons as it would condemn the remotest regions to near subsistence existence. The real cost of a uniform pricing policy is thus accepting low cotton production densities, high per unit costs of assembly and transport and the need to develop a better feeder road system for the entire North.

This study has shown that COGERCO and then ONAFITEX have stabilized the cotton lint price for domestic mills in order to maintain low textile prices for Zairean consumers. For example, in 1973 and 1974 when the world market price of cotton more than doubled producer prices remained unchanged and domestic lint prices were only half or even less than half of export prices. We see no reason why producer prices and domestic lint prices should not be set in relation to world market conditions. Since only a small quantity of Zairean textiles are exported, there is no valid argument for providing cheap lint to the mills. Even during the years when the domestic lint price was 25 percent above the export price FOB Matadi, the domestic price was still below what domestic spinners would have paid for imported cotton because of import duties, taxes, transport and handling costs, etc.

Basically, the question of domestic cotton pricing is one of transferring consumer's surplus into a producer's surplus in order to stimulate cotton production. This author believes that a temporary increase in the domestic lint price of 15 to 20K. per kg. will generate enough revenue to enable ONAFITEX to raise the producer price from 6.5K. to 10 K. per kg. of first grade seed cotton. Such a price would substantially increase cotton production, reduce per unit marketing and processing costs and provide ONAFITEX with substantial export earnings.

A price increase of 15 to 20K. per kg. of cotton lint for domestic spinners would raise the price of domestic lint to about 60 to 65K. per kg. of lint, still well below the price which they would have to pay for imports of the same grade and quality. The uncertainties associated with such a scheme are the assumptions that cotton lint export prices will remain high and that farmers would react fairly quickly to a 50 percent increase in the producer's price.

Cotton pricing policies cannot be divorced from price policies for other crops, especially since many of the other crops are grown either in a rotation with cotton or are in competition for labor with cotton. Thus, pricing policies need to be designed for a cotton-food-export crop production system.

In Zaire, low producer prices are fixed for all basic food and fiber crops in order to protect the real incomes of urban consumers. In fact, this is the major contradiction in agricultural policy in Zaire and in developing northern Zaire. Since agriculture has been declared the priority of the priorities, the time is ripe to shift from negative price policies which depress agricultural prices to positive price policies which provide adequate incentives to farmers to raise agricultural production and income and to assist Zaire in becoming self-sufficient for the basic food staples.

Diffusion of Improved Agronomic Practices

Although experimental plots with improved agronomic practices and no chemical fertilizers consistently produce more than 1,000 kg. of seed cotton per ha., we find that farmers' yields average around 400 kg. Thus, there is a large opportunity for increasing yields by introducing improved agronomic practices.

There is a body of improved cultural practices which were recommended by INEAC before 1960, INERA after 1960 and the CFDT-mission in Ubangi-Mongala. These improved agronomic practices include recommendations on: (a) duration of fallow, (b) crop rotation and intercropping, (c) use of improved hand tools (d) choice of field plots, (e) land preparation, (f) time and method of planting, including plant density, (g) timing and method of thinning and weeding, (h) disease and insect control, (i) time and method of harvest and (j) sorting of cotton, storage of seed cotton and storage of cotton seeds.

These improved agronomic practices could be extended immediately to farmers. The cotton extension service should concentrate on the introduction and diffusion of improved agronomic practices. Demonstration plots in selected villages would be very useful in showing farmers what could be achieved. For its part, ONAFITEX should sort cotton seeds in the ginneries and disinfect before distribution to farmers in order to improve germination rates and to assure adequate plant densities.

In the next section, we will advocate an overhaul of the cotton extension service to facilitate the introduction and diffusion of improved agronomic practices possible. In particular, we believe that the creation of regional cotton extension committees could be very useful for launching a cotton extension campaign to diffuse improved agronomic practices.

Overhauling the Cotton Extension Service

Unless the agricultural extension service is reformed and retrained, there is little hope that better agronomic practices will be observed by farmers or that pilot cotton development projects will succeed. Several actions need to be taken to reform the cotton extension service in order to shift it from a regulatory to an educational agency.

The administrative structure of agricultural extension should be reformed in order to coordinate and integrate agricultural extension efforts. Agricultural monitors responsible for cotton extension should be placed under a single authority instead of three different ones as is presently the case. This authority does not necessarily need to be ONAFITEX although this would facilitate the organization of cotton extension. ONAFITEX which by decree is responsible for providing technical services to cotton farmers needs a certain degree of control over the cotton extension service. ONAFITEX will need a cadre of well trained cotton extension officers who will be in charge of developing and implementing an overall cotton extension program.

Agricultural extension workers need to be retrained continuously through formal training sessions and by means of extension bulletins, extension seminars, etc. Their performance should be reviewed periodically. Promotions, transfers, etc. should be a function of their effectiveness. Training should include recommended agricultural practices, the design of demonstration plots,communication skills and elementary farm management, particularly partial budgeting techniques.

The function of extension agents also needs to be reviewed and they should be provided with adequate transportation, facilities for field work and demonstration plots, opportunities for professional advancement and supportive personnel and services. They should have the opportunity to provide feedback information to the officer in charge of developing and implementing the cotton extension program.

In order to better organize and coordinate cotton extension efforts, a cotton extension committee should be appointed in each regional branch of ONAFITEX and charged with drawing up a campaign for the next crop. The committee should be chaired by the regional or national director of the agricultural service of ONAFITEX. The committee should include representatives from the Department of Agriculture, INERA, CFDT, the extension service of ONAFITEX and the regional administration. Members who may be co-opted would be cooperative leaders, customary chiefs, cotton production specialists, etc.

This committee should be responsible for the development of general guidelines for the expansion of cotton production. These guidelines should constitute the terms of reference for all cotton extension agents. Immediate steps should be taken to develop a cotton handbook which summarizes and translates the recommended cultural practices into local languages for all cotton extension agents. Each year, new cotton research results should be added to this handbook.

Presently university trained agronomists at the "graduat" level and the "ingenieur" level have acquired specialized skills for agricultural research but are not well prepared for agricultural extension responsibilities. At the National University of Zaire, there is no department concerned with the problems of diffusion of innovations and agricultural extension. The department closest to this emphasis is the department of communications which is mainly concerned with the mass media: press, radio, TV, film and their impact in urban areas. Thus, there is an urgent need for a department of agricultural extension.

In order to create a capacity for agricultural extension education in Zaire and to focus more attention on the vital role which the agricultural extension service plays in increasing production, incomes and employment, a department of agricultural extension should be set up at the National University of Zaire. This department should develop a curriculum in agricultural extension education including the following fields of study: communications, rural sociology, farm management, agronomy and agricultural development. It is logical that such a department would be created in the Faculty of Agronomy. It could be added to the existing Department of Agricultural Economics or it could be established as a separate department. The major constraint for creating such a department is the shortage of qualified staff in this field, either Zairean or expatriate.

Graduates in agricultural extension will assume leadership in extension positions in the Department of Agriculture, in ONAFITEX and in other product marketing offices. They will be responsible for the training and upgrading of agricultural extension workers.

An extension liaison department should be created in INERA to ensure that research findings are diffused via the agricultural extension service and that there is constant feedback into the research system. This unit should provide liaison between extension workers and researchers which at present appears extremely weak. A major responsibility of this department would be the preparation and distribution of extension bulletins. This unit could also provide the needed link between INERA and ONAFITEX, between INERA and the CFDT mission, and between INERA and the Faculty of Agronomy.

A Pilot Cotton Development Project in Bas-Uélé

The dispersion of cotton production in northern Zaire, fostered by uniform seed cotton prices, is largely responsible for the high assembly and transport costs, particularly in the Uélés where production densities are the lowest. A strategy to increase cotton production will require specialization of cotton production in a particular area and concentration in a pilot cotton development project. In this respect, the potential for increasing cotton production in Bas-Uélé is particularly high. Yields are already relatively high, on the average 687 kg. per ha., but the variation in yields between farms is also large. Some farmers obtained yields of 1,200 to 1,600 kg. per ha.

indicating that substantial improvements in yields could be achieved by the majority of the farmers. Compared to the 1959 situation, acreages per farm are now much smaller and the number of cotton farmers is now much lower.

A pilot cotton development project, centered in Bambesa and focusing on extension of improved agronomic practices,would have a great potential for increasing cotton production. This area is one of the best cotton producing areas in Zaire. The primary objectives of such a project would be threefold: an increase in yields to an average of 1,000 kg. per ha.; an increase in average cotton acreage per farm to 50 ares and an increase in the number of cotton farmers. The feeder roads should be improved and provisions should be made that the ginning mills located in the area are able to handle the increased production. Farmers should also receive guarantees that their production will be bought up early.

A project similar to the CFDT project in Ubangi-Mongala should test the potential of improved agronomic practices under actual farm conditions in the Bambesa area. As the ecological conditions for cotton production in Bas-Uélé are much better than in Ubangi-Mongala, the payoffs of such a project would largely surpass those for Ubangi-Mongala.

The project should start in the paysannat of Bambesa, also known as the paysannat of the Babua, which was one of the showpiece settlements before independence [Young, 1965]. Farmers in paysannats have been exposed to intensive agricultural extension efforts and they are generally regarded as the most progressive farmers. However, in the present political context of Zaire the paysannat formula should be adapted to suit present objectives of social organization and authenticity. Paysannats will have to conform to traditional forms of organization and control, and they need to be integrated into the local political party structure in order to survive.

Accelerated Research on New Varieties

Improved cotton seeds can be very effectively distributed to farmers as all farmers receive seeds from the ginneries each year. In fact, the distribution of seeds requires very little administrative capacity since the seeds are distributed to the farmers during the collection of second grade seed cotton. The variety presently cultivated in the North, Reba B 50, is well adapted to local ecological conditions. Its resistance to wilt and bacteriosis is a major asset in this humid climate. Since 300 tons of Reba B 50 seeds were imported from the Central African Republic in 1967, no new seeds were introduced and there is a serious degradation in varietal purity. This is evidenced by the reduction of average fiber length from 1 3/32" in 1967 to 1 1/16" in 1974, the heterogeneity of fibers, the decrease in ginning percentage and the appearance of wilt and bacteriosis in certain areas.

In 1974, according to ONAFITEX agents in Gemena, the blue disease appeared in cotton fields along the Ubangi river. If this decrease spreads, it will be necessary to introduce a new variety resistant to this pest. Research on this disease is presently underway in the I.R.C.T. research station in Bambari, Central African Republic.[1]

[1] Source: CFDT-mission in Gemena.

Since 1971 the INERA station in Bambesa has been multiplying purebred seeds of Reba B 50 from the Gandajika station in the South. These seeds have then been further multiplied in paysannats (the Babua paysannat in Bambesa) before distribution to farmers. In 1971 the Bambesa station multiplied 5 hectares and in 1972-1973 15 hectares.[2] Different cotton varieties are being compared in the Bambesa station as well as in the Boketa station. The CFDT mission in Ubangi-Mongala now plans to multiply 2 tons of seeds from the Bambesa station for distribution in Ubangi-Mongala.

Clearly, research for improved varieties yields high payoffs. As new physiological strains of parasites (mutants-biotypes) develop spontaneously, breeding and selection of pest and disease resistant varieties need to be a continuing activity.[3] The major challenge is to combine resistance genes with others having high productivity or commercial qualities. When cheap fertilizers become available in Zaire, it may be economical to breed for high yielding fertilizer responsive cotton varieties.

Presently, cotton breeding and selection in Zaire is concentrated in the well equipped INERA station of Gandajika in the South, in a savannah area. Since 1964 they have developed improved varieties for the southern cotton belt but not for the northern. Present staff

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[2]In 1972 they obtained yields of 600 kg. per ha. with late planting and as a first crop after fallow. In 1973 yields were 1,500 kg. per ha. with planting between 15 and 20 July, spacing of 100 cm x 30 cm, mechanized tilling and weeding and treatment with DDT cotton dust.

[3]Cotton resistance to insects is characterized by abundant production of gossypol in the vegetable parts, absence of nectaries and bractless bolls [National Academy of Sciences, 1974].

availability does not permit the development of separate cotton breeding and selection stations fro the North and South. As soon as adequate and competent staff become available, the Bambesa station should be geared up for cotton improvement research for the northern cotton belt. The North badly needs its own research program, as ecological conditions in the South are different from the North. In the meantime, better cooperation between the French IRCT stations in West and Central Africa, INERA in Bambesa, Boketa and Gandajika, the agricultural service of ONAFITEX and the CFDT-mission in Ubangi-Mongala is desirable for restoring and maintaining the varietal purity of Reba B 50, for the identification of a better variety and for gaining access to improved varieties developed in other countries.

Chemical Fertilizers

The farm business survey has shown that chemical fertilizers are not being used in the North by any of the 129 farmers in this sample. In this section, we will analyze a fertilizer strategy for expanding cotton production. First, we will review the experiences with chemical fertilizers in Zaire, then we will discuss the major constraints on using fertilizers and finally, we will evaluate a fertilizer strategy for expanding cotton production in northern Zaire.

Since chemical fertilizers have not been discussed elsewhere in this study and since the government has decided to create a domestic fertilizer industry, more attention will be devoted to this strategy than to the other ones discussed in this chapter.

Review of Experiences with Fertilizers in Zaire

The first controlled experiments with fertilizers on cotton in Zaire were set up in 1935 in the Bambesa experiment station of INEAC [FOCAN, 1950]. It was concluded that nitrogen had a weak effect, that phosphates had the most pronounced effect and that potash also had a real positive effect. Increasing doses of N, P, K increased yields although at a decreasing rate. However, there were only a few repetitions in the experiment and the soil was far from homogeneous. INEAC also experimented in Bambesa with organic fertilizers and found that ten tons of cotton seed compost per hectare increased yields by 57 percent. Cotton seed ashes showed a pronounced effect as 800 kg. of ashes per hectare increased yields by 73 percent. Fresh cotton seed had a positive although weak effect, while half-decomposed banana debris showed a doubtful effect.

Contrary to the Bambesa results experiments with chemical fertilizers on cotton in the INEAC experiment station of Gandajika in 1940 demonstrated a significant effect on nigrogen and a less pronounced although positive effect on phosphates and potash. And 450 kg. of ammonium sulphate per hectare increased yields by 41 percent.[4]

After World War II INEAC undertook several experiments in continuous cultivation with chemical fertilizers in forest areas and savannahs in the northern cotton belt. These experiments were set up

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[4]Too much nitrogen stimulates vegetative development of cotton and reduces fiber production. Forest soils are often nitrogen rich while savannah soils, more exposed to the sun and biochemical decomposition, often lack nitrogen. This may explain the difference between the results of Bambesa, in the forest area, and Gandajika, in the savannah area.

in the INEAC research stations of Bambesa, Boketa, Kutubongo and Magombo and throughout the bio-climatic regions of the North.

The effects of types of fertilizer and rates of application on yields of various crops in a rotation and on the regeneration of soil fertility and the need for fallow were studied. Jurion and Henry [1969] discussed these experiments in detail and we will limit ourselves to the major conclusions.

In Bambesa, a forest area, an annual application of 100 kg. triple superphosphate per hectare and 100 kg. ammonium sulphate per hectare produced two weeded crops per year (for instance, groundnuts and maize or cotton) for at least six years without evidence of any serious deterioration in soil fertility. Average seed cotton yields between 1,600 and 1,700 kg. were obtained with favorable weather and 1,350 kg. with average weather. Without chemical fertilizers, production in the sixth year was 60 percent lower than in the first year.

All trials carried out at Bambesa and throughout the same bio-climatic zone showed the importance of phosphorous on these iron rich soils (ferrisols). The recommended doses for cotton were 100 kg. triple superphosphate per hectare and per year and a light dressing of ammonium sulphate from the third year onwards at a rate of 100 kg. per hectare. Since 1958 the use of fertilizers has been extended to farmers in paysannats in order to prolong the cultivation cycle by one year and to cut the effort needed for land clearance by one-third.

In the Ubangi forest area the Boketa station with a network of local trials found that soils did not react well to chemical fertilizers and that maintaining the soil's fertility was complicated. Here organic matter played a much more important role than it did in the Uélés. Nitrogen was identified as a principal influence and phosphorous as a secondary one, with the action of these elements being relatively weak (a 24 percent and a 19 percent increase in cotton yields, respectively), often irregular and always uneconomical.

At the Kutubongo station in northern Ubangi, located in a savannah zone and dominated by Imperata Cylindrica, trials brought out the importance of nitrogen and phosphorous and the inefficacy of potash. However, the natural productivity of these soils is very low and even production increases of 50 to 100 percent are not likely to make fertilizer applications economical. Similar results occurred in studies conducted in the Magombo station in northern Uélé in the Guinean savannah: a significant effect on cotton yields from nitrogen and phosphorous, but not enough to make application economically justified.

In the southern cotton belt ferralsols from quartzites reacted best to chemical fertilizers, but heavy fertile ferralsols did not react at all for some unexplained reason. If the effect on the whole rotation was taken into account for ferralsols from quartzites, the results proved that chemical fertilizer use was economically sound. Moreover, there was a very strong indication that continuous cultivation of land was feasible.

The CFDT Mission started small scale fertilizer trials for cotton in Ubangi-Mongala in 1973. The results showed that application of 100 kg. fertilizer 20-20-0-6 (N-P-K-S) per hectare in side dressing one week after planting does not automatically return a net profit (Table 9.1).[5] The most fertile soils, those with highest yields on the control fields, responded best to fertilizers. Only one dose, 100 kg. per hectare, was applied and the results were compared with nonfertilized experimental plots. Good cultural practices were maintained on the fields.

Table 9.1. Republic of Zaire: Effect of 100 kg. 20-20-0-6 Composite Fertilizer per ha. in Side Dressing, One Week After Planting, on Experimental Cotton Fields in Ubangi-Mongala, 1973-1974[1]

Experimental Fields	Yield in kg./ha. on Control Fields	Fertilizer in kg. Seed Cotton per Hectare	Response in Zaires	Net Profit of Net Loss in Z/Hectare[2]
1	1,433	517	34	26
2	1,015	97	6	- 2
3	438	62	4	- 4
4	1,180	346	22	+14
5	635	166	11	+ 3

[1]ONAFITEX, Direction Régionale Nord-Ouest, May 1974. "Essais Agronomiques 1973." Gemena: Mission CFDT.

[2]Fertilizer 20-20-0-6 cost 8K/kg.; seed cotton price was 6.5K/kg.

In conclusion, the INEAC and CFDT experiments showed that the use of chemical fertilizers for cotton production could be economically justified, depending on the soil type and whether or not the effect on the whole rotation was taken into account. Yields could be raised

[5]The fertilizer was flown in from the FED-CAK project in Eastern Kasai; the bags were wet and the fertilizer had hardened.

significantly and labor saved for the farmer because of a prolongation of the cultivation cycle and a less frequent need to clear land. However, the optimum doses for financial profitability were not studied properly [Tshibaka, 1974]. Most studies indicated either that they had an economic effect or that an economic effect could not be proved. In fact, the rates of application (0 kg., 100 kg., 200 kg., etc.) usually did not permit a detailed study of the economics of fertilizer use.

Major Constraints on Using Fertilizers

Fertilizers have been used in Zaire for many years mainly by commercial plantations growing export crops such as oil palm, coffee, rubber, cocoa, tea and by plantations growing sugar cane. Small quantities have also been used for vegetable production around the major cities but practically none for the basic food crops and cotton, except in some isolated development projects.

Imports of fertilizers reached 13,222 tons in 1959 and declined sharply in the 1960s because of internal disorders and general import quotas due to a lack of foreign exchange. They reached the pre-independence level again in 1969 and are now increasing.

Compared to West African countries, Zaire is a very small consumer of fertilizers with less than 1 kg. per head in Zaire and over 10 kg. per head in most West African countries [Verhaegen, 1970b]. Moreover, consumption in most of the West African countries is increasing at a rapid pace.

In this section we will diagnose the major constraints to using chemical fertilizers in Ziare, constraints which explain the low level of present fertilizer consumption.

The High Cost of Fertilizers

Fertilizer prices in Zaire are very high. Table 9.2 presents prices in K per kg. for different types of fertilizer shipped to various ports and unloading stations in the northern cotton belt. Several factors explain these high prices.

Origin. Zaire does not produce any chemical fertilizers and does not have a granulation, bulk blending or bagging plant. Fertilizers are obtained mainly from the common market countries in Western Europe,[6] a fact which accounts for expensive ocean freight charges.

Fertilizers could be obtained at a cheaper rate from African countries. South Africa, Rhodesia and Mozambique could export fertilizers to Zaire at a price c.i.f. Zaire well below the cost of fertilizers obtained from Europe [Hedley and Good, 1971]. Yet trade between Zaire and these countries raises a political problem although there is already a brisk trade. Angola, Kenya, Uganda and Tanzania are also producing fertilizers or fertilizer nutrient concentrates and could probably export to Zaire at a fraction of the prices for fertilizers bought from Europe. The major problem seems to be the establishment of the proper commercial channels.

Another alternative for Zaire is to produce its own fertilizers, particularly nitrogen from liquified air. The political bureau of the M.P.R. party in Zaire decided in its meetings of December 28-30, 1974 to create a domestic fertilizer production industry [Zaire, 1975]. Pre-investment studies have been completed for a nitrogen fertilizer

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[6]Recent devaluations of the U.S. dollar to which the Zaire is pegged have made imports from Europe even more expensive.

Table 9.2. Prices for Different Types of Fertilizers and Different Locations in the Northern Cotton Region, 1971 (in K. per Ton, from the Colimpex Company in Kinshasa)[1]

Locations	Urea CH_4N_2O	Ammonium Sulphate $(NH_4)_2SO_4$	Potash Sulphate K_2SO_4	Triple Super Phosphate $CaH_4(PO_4)_2$	Composite 17-17-17 N P K
Kinshasa	8,200	4,700	7,300	7,500	8,800
Akula	8,625	5,125	7,725	7,925	9,225
Bumba	8,637	5,137	7,737	7,937	9,137
Aketi	8,702	5,502	7,802	8,002	9,202
Mungbere	9,779	6,279	8,879	9,079	10,379
Kisangani	8,691	5,191	7,791	7,791	9,291

[1] [Hedley and Good, 1971].

plant to be located at Inga where cheap hydro-electric power can facilitate its establishment.[7] Reported resources of natural gas in the Kivu and of phosphate rock could also play an important role in establishing a national fertilizer industry [McCune, 1972]. In fact, the Republic of Gabon, close to Zaire and to Inga, has large phosphate reserves.

Transport Costs. Half or more of the cost of fertilizer in Zaire is attributable to transport costs. AMIZA, the national Zairean

[7] Inga is located on the Zaire river rapids between Kinshasa and Matadi, about 30 km. upstream from the port of Matadi. The hydro-electric potential of these rapids is enormous, estimated at 30 million kw. for year round operation. The first power station, Inga I, with a capacity of 300,000 kw., started operating in 1972. Inga II is now under construction. By 1980 the total operational capacity of Inga is planned at 3 million kw. or one-tenth of the potential capacity of the Inga site. A high power line now under construction will transport electricity from Inga to the rich mining regions in Shaba.

shipping agency, reported that shipping fertilizers in 1971 from Antwerp via Matadi to Kisangani would cost 35.73Z per ton; to Isiro 44.96Z; to Libenge 36.22Z, prices which included ocean freight, handling costs, duties and taxes and shipping costs in the interior. Thus, transport costs and taxes and duties amounted to between 3 and 4 K per kg. of fertilizer.

Most fertilizers are imported in small lots, although buying in large quantities could possibly reduce freight costs and purchase price [McCune, 1972]. Another possible means of cost savings would be the importation of concentrated fertilizers or fertilizer nutrients and blending them with inert fill in Zaire. Presently, low analysis fertilizers such as ammonium sulfate (21 percent N) are commonly imported, together with some urea (46 percent N). The cost per unit of nitrogen in urea is much lower than in ammonium sulfate (see Table 9.3). If only high analysis fertilizers were imported, substantial savings could be realized. A local bulk blending and bagging plant would then be necessary to arrive at the desired grades. Such a plant does not require a lot of capital or managerial skills and could be set up quickly.

Shipment to interior ports in Zaire by ONATRA, the national river transport agency, is expensive. It takes up about 25 to 35 percent of the total transport costs from European ports to interior ports or unloading points in northern Zaire. Fertilizer is classified as general merchandise, the most expensive fare category, although fertilizers do benefit from a 25 percent reduction in total fare. Overland transportation is also very expensive, on the average 10 K per ton and per km. for general merchandise if no return freight is

Table 9.3. Republic of Zaire: Fertilizer Nutrient Cost in Gemena, 1971 (in K. per ton)[1]

	Urea	Ammonium Sulphate	Potassium Sulphate	Triple Super Phosphate	Composite
Delivery from Kinshasa (Colimpex) to the port of Akula via ONATRA	8,625	5,125	7,725	7,925	9,225
Road transport Akula-Gemena 115 km. x 10 K/ton and /km.	1,150	1,150	1,150	1,150	1,150
Total Cost in K. per Ton	9,775	6,275	8,875	9,075	10,375
Nutrient content in Percentage	46% N	21% N	48% K_2O	40% P_2O_5	17-17-17
K. per ton of nutrient	21,250	29,881	18,490	22,688	(1)

(1) The nutrient value of composite fertilizer 17-17-17 calcualted at the nitrogen nutrient price of urea (3,612.5 K per ton composite), the phosphate nutrient price of triple super-phosphate (3,857.0 K per ton composite) and the potash nutrient price of potassium sulphate (3,143.3 K per ton composite) adds up to 10,612.8 K per ton. This is higher than the actual cost of composite fertilizer (10,375 K per ton) although the difference is slight. However, since the nitrogen source in 17-17-17 is ammonium sulphate, the imputed nutrient value of composite fertilizer at the nitrogen nutrient price of ammonium sulphate (which is 5,079.8 K per ton composite) is 12,080.1 K per ton, well above the actual cost of 17-17-17 fertilizer.

[1] [Hedley and Good, 1971] and this author's own calculations.

available. With return freight, the rate is half. In order to reduce the effect of transport costs on fertilizer prices, only highly concentrated fertilizers should be imported, preferably from suppliers within Africa. Granulation, blending with inert fill and bagging could be done in Zaire at low cost. Fertilizers should also be assessed a lower fare rate by ONATRA.

Custom Duties and Taxes. The following duties and taxes were imposed on imported fertilizers until January 5, 1973:

import duty	5%
statistical tax	3%
turnover tax	9%
conjuncture tax (temporarily)	5%
Total	22%

Duties and taxes raised fertilizer prices by 22 percent and generated an estimated 90,000 Z in the government revenue [McCune, 1972]. Clearly, government policies were not favoring the importation and utilization of fertilizers. Most developing countries subsidize rather heavily the import of fertilizers in order to stimulate domestic agricultural production. In its meetings of December 28-30, 1974 the political bureau of the M.P.R. party decided to drop all remaining import taxes on agricultural inputs in order to stimulate agricultural production [Zaire, 1975].

Inadequate Delivery Systems. Fertilizers are distributed by private companies in Zaire, a distribution system is geared to commercial plantations. The distributors have offices in the major cities but virtually no sales agents in rural areas. This makes it very difficult for smallholders to acquire small quantities for their own use. Moreover, large buyers receive considerable price discounts. Most dealers have at least two prices, one for buying a bag or a few bags and another for buying 50 tons or more. The price may differ as much as 20 Z per ton [McCune, 1972]. Thus, small farmers have an economic disadvantage in buying fertilizers vis-a-vis the large plantations, unless they might pool their orders.

Low Product Prices

Presently, practically no fertilizer is used on food crops nor on cotton except in development projects such as the FED-CAK project in Eastern Kasai and the CFDT project in Ubangi-Mongala. Yet the results of fertilizer applications in these projects are promising if cost-benefit ratios can be improved. Fertilizer prices are high, on the average about 7 K per kg. of fertilizer, and product prices are relatively low.[8] We have already indicated that seed cotton prices are low. Most food crop prices were raised in 1973 or 1974 and this should have a favorable effect on the cost-benefit ratio of using fertilizers on cotton and on food crops in the rotation (direct effect and residual effects).

If one uses the marginal principle, the last kg. of fertilizer applied on a cotton field must produce at least one to one and a half kg. of seed cotton, depending on the type of fertilizer used--one kg. for ammonium sulphate to one and a half kg. for urea, potassium sulphate

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[8]Fertilizer prices at Colimpex, Kinshasa ranged from 6.3 K to 10.3 K per kg. and nutrient costs ranged from 18.5 K to 22.7 K per kg. in 1971. The seed cotton price for first grade was 6.5 K per kg. in 1972, 1973 and 1974.

triple super phosphate or composite fertilizer. On a fertilizer nutrient basis, the last kg. of nutrient applied must increase cotton production at least by 3 kg. of seed cotton, depending on the type of fertilizer used. Thus, the average productivity of fertilizers must even be higher, in the order of 4 kg. or more per kg. of nutrient. This requires fertilizer responsive cotton varieties and adequate plant protection, a point which brings us to the next constraint.

Lack of Fertilizer Response Data

Presently, very little research is done in Zaire on fertilizer response except in the South for maize in the National Maize Program and in the Kasese-Kaniama project.

Although fertilizers are used for cotton production in the FED-CAK project in Eastern Kasai, it is difficult, if not impossible to derive accurate benefit-cost ratios for fertilizer application in this project. Soils in Eastern Kasai are also quite different from soils in either Ubangi-Mongala or in the Uélés.

INERA concentrates on genetic cotton improvements and does not carry out fertilizer trials on cotton.[9] CFDT in Ubangi-Mongala is engaged in some interesting experiments but, since only one rate of application is applied, no production functions and, thus, no optimal doses can be derived. Research on fertilizer use for cotton production by INEAC before 1960 showed that soils in the Uélés gave the most favorable response; however no experiments are now organized in this region

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[9]The 1973 INERA program provided for a series of fertilizer trials on cotton in Gandajika but they were not implemented. The 1974 program repeated the trials planned for 1973.

although the potential for increasing cotton production in the North is the greatest for the Uélés.

Sociological Factors

Cotton farmers and cotton extension workers have no experience with chemical fertilizers. Thus, the introduction of chemical fertilizers into traditional farming will encounter many obstacles. Fertilizers will have to be quite profitable and have low risk for farmers in order to overcome traditional resistance to change.[10] As farmers will not be able to pay for this new input, credit institutions will have to be developed. Pesticides will also be needed as research has clearly demonstrated the need for pest control in tropical agriculture when fertilizer is used.[11] Thus, the problem of introducing chemical fertilizers is one of introducing a package of innovations along with a rather drastic change in cultural methods. Communications research will be necessary before launching such a new technological package. In the South of Zaire demonstration plots with high yielding hybrid maize and fertilizers proved to be very effective in influencing the adoption of these new inputs. But this adoption was facilitated by substantial government or external financing, supports which will be necessary to introduce this new technological package throughout Zaire and to overcome the initial reluctance of farmers to change their

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[10] According to Verhaegen [1970b] the ratio of increased revenues to increased costs as a result of fertilizer applications must reach at least two to assure adoption.

[11] Cotton acaridosis reaches much more dangerous proportions where cultivation is intensive; nitrogenous fertilizers make cotton plants more attractive to Lygus Vosseleri [Jurion and Henry, 1969].

time-worn agricultural methods. New technologies are unlikely to become adopted unless they fit into a production system adapted to the farmer's goals, opportunities and resources.

The Agricultural Extension Service

Unless the agricultural extension service is reformed and retrained, there is little hope for promoting fertilizer use in traditional agriculture. If the government decides to introduce chemical fertilizer on a large scale, then major efforts need to be made in the development, training and support of extension staff.

Conclusion

The use of chemical fertilizers for cotton production shows promise but cannot be recommended as a major strategy for increasing cotton production. This study has shown that some major constraints limit the use of fertilizers, that the economics of fertilizer use on cotton production is questionable and that more research is needed on the economic effects of different types of fertilizers and different rates of application.

If seed cotton prices are increased and if fertilizer prices are decreased, then it might be profitable for cotton farmers to use fertilizer.

The fertilizer price could be lowered by importing highly concentrated fertilizers, preferably from suppliers within Africa, by removing all remaining import duties and taxes and by reducing the fertilizer transport rate schedules of ONATRA and other public and semi-public transport agencies. Granulation, blending with inert fill and bagging should be done in Zaire.

Zaire has recently decided to create its own fertilizer industry. Thus, efforts should be undertaken to introduce chemical fertilizers in pilot cotton development projects and then later among smallholders if it proves profitable. The government should seriously consider the subsidization of fertilizers in order to promote their introduction among smallholders. At the same time, an input delivery system should be set up which focuses on smallholders.

Pesticides

Basically, there are three kinds of chemicals which can be used to control cotton pests: insecticides to combat insects and spiders and the parasites (bacteria, fungi, viruses) they transmit, fungicides to protect plants against fungi and herbicides to combat weeds. Birds and rodents inflict virtually no damage on cotton but are serious predators of food crops. In this section we will concentrate on the application of insecticides and fungicides on cotton.

Herbicides may hold a bright future for weed control in cotton when labor becomes scarce and expensive. Weeding is a critical activity in cotton production and herbicides could fulfill a useful role in this respect. Presently, they are unknown in traditional agriculture in Zaire and their cost is probably prohibitive.

Review of Experiences with Pesticides

Cotton is undoubtedly the plant whose parasites have been the most closely studied. In Zaire the use of insecticides on cotton started in 1952. In the northern cotton belt insect control programs were undertaken for the first time in 1954 and were confined to places infested with Helopeltis. Nearly 5,000 hectares of cotton were treated for Helopeltis in 1955 and 1956; a second pass was needed on 33 hectares in 1955, but none in 1956. In those two years the rate of infestation dropped to three insects per 1,000 plants. In Ubangi 6,000 and 10,000 hectares, respectively, were treated in the course of the 1957 and 1958 seasons. In 1959 445 hectares were treated for Helopeltis, the rate of infestation falling from 20 to 1.5 insects per 1,000 plants. Only 200 hectares had to be treated a second time [Jurion and Henry, 1969].

Insecticides are extensively used in the FED-CAK project in Eastern Kasai and in the FIWA-BILI project in northern Ubangi. Since 1972 ONAFITEX has treated cotton fields with insecticides. Only cotton fields grouped in large blocs and close to a road are treated. Farmers have shown virtually no resistance to insecticide applications. The product used was special DDT cotton dust LIMTEX and the dusting equipment was GNOM-41 Platz, portable sprayers or dusters powered by a two-stroke engine. The recommended rate of application was 12 kg. per hectare and per treatment, but many fields received from 15 to 30 kg. per pass. The equipment, however, was not well suited for dusting. Dusting equipment powered by hand which the farmers can buy and use seems preferable to the rather complicated and expensive Platz dusters. However, over 1,100 imported Platz dusters were purchased by ONAFITEX.

The CFDT mission organized insecticide trials in Ubangi-Mongala during the 1973-1974 campaign. A randomized block design was used. Treatments started six weeks after planting and were repeated every two weeks for a total of six treatments. Three insecticides were compared:

--special cotton dust LIMTEX, the product actually used by ONAFITEX, containing 5 percent DDT, 10 percent HCH and 40 percent sulphur.

--Nuvacron Ulvair Combi A400 (CIBA-GEIGY) containing 250 g./l. of DDT and 150 g./l of a systemic organic phosphate (monocrotophos).

--Emulsion Azodrine/DDT (Shell) containing 100 g./l. of monocrotophos and 200 g./l. of DDT.

Very few differences were observed among these three products. Cotton dust seemed more effective against spiders (Hemitarsonemus) and fertilized the plants with sulphur. However, dusting with Platz equipment was quite impractical and would be difficult to introduce to extension agents. The best formula appeared to be ULV (Ultra Low Volume treatment) without water, with a sprayer powered by flashlight batteries and a two to four liter solution per hectare. No water or fuel is necessary and the equipment is very lightweight. One unit is needed per 20 hectares. Seed cotton yields from 600 to 1,100 kg. on the treated fields were obtained. Since the fields treated with dust were control fields a comparison could not be made with untreated fields. Thus, data on the financial profitability of insecticide treatments is not available. However, we believe that insecticide treatment is financially and economically sound in most areas when the proper timing and rates of application are observed. However, spraying or dusting should not become a routine. When the level of infestation exceeds a minimum level treatment should be applied. Thus, control and warning stations are necessary to monitor the level of infestation. Regular insect counts following a sampling plan in selected areas, should be organized, and minimum infestation levels based on economic criteria should be established.

Insecticide treatments should not substitute for indirect methods of pest control such as breeding and selection for genetic resistance to cotton diseases and insect attacks, disinfection or coating of seeds before planting with an organo-mercuric fungicide, sorting of seeds to increase germination rates, uprooting and burning of cotton debris after harvest, observation of recommended rotations, fallow times and time of planting and harvest, and destruction of fields invaded by wilt or other fungus diseases.[12]

Major Constraints on Using Pesticides

Most of the constraints to the use of chemical fertilizers also apply for pesticides. Presently, ONAFITEX treats all fields which can be easily reached. Dusting or spraying is becoming a routine. In order to make treatments profitable, applications need to be a function of the pest population buildup and the expected damage to yields and to cotton quality rather than a schedule of applications determined by the calendar. Thus, regular insect counts, following a sampling plan in selected areas, should be organized and minimum infestation levels based on economic criteria should be established. The farm business survey data shows that only 10.5 percent of the farmers in Ubangi-Mongala and none of the farmers in the Uélés had their cotton fields treated with insecticides in 1972-1973 by ONAFITEX. The Agricultural Service of ONAFITEX is unable to treat all cotton fields because they

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[12]Time of planting and harvesting is particularly important for reducing damage from Helopeltis.

are so dispersed and often located deep in the forest. Thus, the cost of pesticide treatment of cotton fields is not equally supported by all cotton farmers. This could be avoided by shifting responsibility for plant protection to farmers by providing them with locally made hand powered dusters or sprayers and pesticides at a subsidized price to stimulate adoption.

Conclusion

The present trend in agricultural policy in Zaire is for more direct government intervention at the farm level whereby new technologies or agricultural methods are imposed upon the farmer rather than using the agricultural extension service to diffuse, demonstrate, persuade and teach farmers to adopt innovations. Direct government intervention at the farm level, the model adopted under colonial rule, was very successful in the short run but failed to pay off in the long run. The present approach to cotton plant protection is quite paternalistic and is modeled on the colonial experience. For long run success it is necessary that farmers themselves adopt this new technology. This will require an expanded and redirected extension effort.

We believe that the cotton extension service should encourage farmers to purchase locally made hand powered spraying or dusting implements and that farmers should be taught how to operate these implements and when to apply pesticides. To favor introduction of pesticides and hand powered elements, the government should temporarily subsidize these inputs until they are in widespread use.

Mechanization

From 1967 to 1973 the Zairean government spent approximately 17 million dollars on the importation of heavy agricultural machinery, mainly tractors and accompanying implements. Although the subsidization of imports of tractors and related equipment has now been discontinued, mechanization is still advanced as a strategy for increasing agricultural production in Zaire and mechanized plowing is being subsidized by the government. In this section, we will review the experiences with mechanization in Zaire and we will discuss the major problems of a mechanization strategy for increasing cotton production in northern Zaire.

Review of Experiences with Mechanization

From 1950 to 1960 tractor mechanization was tried out on a large scale in Zaire, mainly in savannah soils. In the Imperata savannahs of northern Ubangi mechanized preparation of the soil increased yields by 15 to 24 percent over manual preparation. In the Guinean savannahs of northern Uélé mechanical preparation produced equal or slightly higher yields than manual preparation. Mechanical land clearing and plowing in the Gandajika region (Kasai) resulted in an 18 percent increase in output for the first cotton crop after clearance with a residual effect of a 24 percent increase in maize yields grown after cotton. In the Kongolo area (northern Shaba) mechanized land clearing helped to eliminate Imperata cylindrica and reduced the need for weeding by about 60 man-days per hectare. This made it possible to observe the agricultural time table. Seed cotton production in kg. per farmer increased from 447 kg. to 885 kg. because of a combination of an increase in yields per hectare and a larger acreage under cultivation. However, mechanization is reported to have hastened the deterioration of surface-soil structure.

In Kasongo (Mamiéma) farmers' incomes as a result of mechanization increased in 1957 by 23 percent, in 1958 by 69 percent and in 1959 by 187 percent as compared with hand tilling in 1956. A combination of higher yields per hectare and larger acreages planted was responsible for the increase in farmers' incomes. Farmers paid 937.50 francs (18.75$) per hectare for plowing in 1958 and 350 francs (7.00$) for harrowing. The crop rotation was cotton, maize and groundnuts.

With manual operations, the harvesting of one crop is often not completed before it is time to plow for the next crop. This is the bottleneck that limits the possibility of extending the acreage cultivated by hand according to Jurion and Henry [1969]. In general, the principle of mechanization was readily accepted by the peasants, and in most cases, a few years of propaganda were enough to persuade everyone to adopt mechanized cultivation which reduced the arduousness of agricultural labor. However, in some cases, mechanization had no other result than to increase the farmer's leisure as acreages were not expanded.

In 1958 it was estimated that 11,000 to 12,000 hectare of cotton were plowed with tractors. Farmers paid on the average 900 francs (18.00$) per hectare for plowing and 500 francs (10.00$) per hectare for Rome plowing. Yields in kg. per hectare increased on the average by 15 to 20 percent after mechanical plowing.

Mechanized clearing of a savannah, no matter where it was located in Zaire and however light the tree cover, was not economical. Only in exceptional circumstances was the use of heavy machinery to clear heavy forest cover economical. Mechanization of post-harvest operations (thrashing, drying, etc.) was found very important because it was estimated that about 42 percent of family labor was absorbed in post-harvest activities [Geortay, 1961].

Animal powered mechanization was successful in several regions of Zaire before independence. Draught oxen were used for plowing in western parts of Shaba province (Dilolo, Sandoa, Kapanga) and in the South of Kasai province (Luisa). Local herds exist in these regions, built up outside the tsé-tsé infested areas, and soils are sandy. An oxen training center in Kabelenge (Sandoa) trained farmers in handling draught oxen. Peasants were able to buy a pair of cattle with payment facilities. There were 200 oxen teams in service in the Sandoa-Dilolo territories in 1959 and about 100 teams in Luisa. In 1960 the price for custom plowing with oxen was 250 francs (5.00$) per hectare and 0.15 to 0.20 hectare could be plowed per 4-5 hour day of work. The farmers who used oxen for plowing doubled their average gross income as they could cultivate twice or even three times as much land as they could with manual tilling. Oxen were also used for transport of produce. However, on heavy soils, difficulties were encountered with animal traction. The quality of work was also below that of tractor plowing, but oxen could be used on fields with termite heaps, stumps, etc.

Since 1969 cotton fields in FIWA have been plowed with heavy tractors (type FIAT 70 C with NARDI disc plows). In 1971 the BILI region was added to this project. Farmers had to pay 5 Z per hectare for tractor plowing in 1969, half at the time of plowing, half after harvest. In 1970 the rate was increased to 6Z per hectare and in 1972 to 8Z per hectare. In 1973 it was estimated that tractors needed to be replaced after 4,000 hours of operation and disc plows after 2,000 hours. Operating expenses, excluding the costs of expatriate garage personnel paid by the Belgian Aid Mission, and service parts for tractors and plows received from the government, were, in Zaires per hectare:[13]

Gasoline	0.33
Diesel Fuel	3.07
Oil	0.54
Tractor Drivers	1.50
Total	5.44Z[14]

Average cotton yields in FIWA and BILI were between 800 and 1,000 kg. per hectare with tractor plowing,strict observation of recommended cultural practices and several treatments with DDT cotton dust. Average yields in Ubangi-Mongala in 1972-1973 were only 257 kg. (Table 6.22). The average cotton acreage per farm in FIWA-BILI was about one hectare. The farm business survey in Ubangi-Mongala showed the average cotton acreage per farm to be only 40.0 ares (Table 6.22).

Although detailed information on farmers' incomes in the FIWA-BILI project could not be obtained,it is generally believed that incomes were considerably above those of farmers outside the project area. The

[13]In most development projects, the cost of expatriate personnel is not included in profitability calculations.

[14]The doubling of all fuel prices in 1974 substantially increases the variable cost of tractor plowing.

project staff estimated that a family could produce each year 800 kg. of seed cotton on one hectare, resulting in gross revenues of 800 kg. x 0.06Z = 48.00Z and 1,400 kg. of unshelled groundnuts on another hectare, amounting to 1,400 kg. x 0.04Z = 56.00Z and 4,000 kg. of dry manioc chips on a third hectare earning 4,000 x 0.025Z = 100.00Z. In this example the cost of tractor plowing is 2 hectare x 8.00Z/hectare = 16.00Z and gross revenues are 48.00 + 56.00 + 100.00 = 204.00Z. The crop rotation is cotton as the first crop in the rotation, planting in June, harvest in November-December, then groundnuts from March to June and, finally, manioc from July to the end of the next year. Thus, each farmer would have each year three one hectare fields of which two hectares would be plowed mechanically. It is doubtful whether family labor would be sufficient to harvest one hectare of groundnuts in May-June, to plant one hectare of cotton seeds in June-July and to plant manioc cuttings in July-August. More research is needed to find out if this scheme is feasible.

Several farmers in the FIWA-BILI project did not harvest all cotton on their fields which indicated that harvesting can become a major labor bottleneck when fields are tractor plowed.

In July 1972 a Ministry of Agriculture conference on tractor mechanization was held in Kinshasa and experience with tractor mechanization in FIWA-BILI, MBANZA-NGUNGU, RUZIZI valley and GANDAJIKA were reviewed. All these projects were using the same type of equipment which had been supplied by the Zairean government. Total costs for tractor plowing were between 15 and 19.5Z per hectare. Farmers had to pay 19.5Z per hectare in MBANZA-NGUNGU, 8.00Z in FIWA-BILI, 6.00Z in the RUZIZI valley and 8.00Z in Gandajika. All these projects employ expatriate personnel which is not accounted for in the cost of tractor mechanization.

Major Problems of Mechanization

Many agricultural development projects in Zaire rely heavily on tractor mechanization, yet the financial and economic impacts of mechanization have not been carefully analyzed. Thus, a careful study should be made of the potential of selective mechanization policies for the development goals of Zaire, such as attaining self-sufficiency in basic foodstuffs, increasing rural employment and income generation and promoting rural development in general. Animal powered mechanization, abandoned since 1960, should be considered and studied for its potential contribution to rural development, particularly in the savannahs of the North and South which are sandy and are relatively free of tsé-tsé flies.

It has been shown that tractor mechanization can improve the peasant's income, provided he cultivates a larger area and adopts the recommended cultivation techniques to ensure high yields from his crops. These conditions, however, are not always met.

Many tractor and tractor implements are misused or badly maintained. This stems from inexperience, poor training of mechanics and drivers, lack of service parts, ignorance of the actual cost of these machines and, generally, machinery that is poorly adapted to tropical working conditions. Most tractors accumulate far less total working hours in a tropical environment than in temperate regions.

The main advantage of tractor mechanization is that it enables farmers to increase the acreage under cultivation. The time needed for land preparation is drastically reduced, weeds are less of a problem and, thus, the agricultural calendar can be more easily observed. Nevertheless, there is not always a yield per hectare increase associated with tractor plowing, and tractor mechanization may damage physical soil structure, particularly when the soil is wet. And yields per hectare do have a decisive effect on the profitability of mechanized cultivation.

Many fields cannot be mechanically tilled, particularly in forest areas. Termite heaps and tree stumps make tractor cultivation impossible. Many fields are located deep in the forest and can only be reached by a narrow, winding path, crossing rivers and creeks. This explains why mechanization has been mainly restricted to savannahs. Farmers also have to group their fields in large blocks close to a road for tractor mechanization.

Mechanical picking of cotton in Zaire at present wage rates is uneconomical. In the U.S.A. a skilled hand picker can gather around 300 pounds (136.1 kg.) of seed cotton per day under ideal conditions. A modern mechanical picker under similar conditions can gather cotton at the rate of 300 pounds per quarter hour. The break-even point for mechanical picking even on U.S. small farms as long ago as 1954 occurred at a wage rate of $9.00 per day [Sinclair, 1968]. In Zaire with wage rates at $1.00 per day or less it is obvious that mechanical picking is not feasible for many years to come.

There is still room for substantial improvement in the basic tools and equipment used by farmers. Improvements could be made in the design as well as in the quality. In particular, the supply of these implements in rural areas at reasonable prices needs urgent government attention.

Conclusion

Presently, tractor mechanization of cotton production in the North cannot be recommended. All mechanization projects in Zaire rely heavily on expatriate management and the economic effects of tractor mechanization have not been studied properly to justify tractor mechanization. However, the government should take steps to improve the supply of improved hand tools and equipment in rural areas of the North.

Agricultural Credit

Lack of agricultural credit is often seen as a constraint on agricultural production in developing countries. In this section, we will review the experiences with agricultural credit in Zaire and discuss the administration of agricultural credit. In that context, cooperatives will be reviewed briefly for their potential in channelling credit to smallholders. We will conclude by evaluating a credit strategy for expanding cotton production in northern Zaire.

Experiences with Agricultural Credit

Agricultural credit was given to white settlers (called Colons) in southern Shaba as early as 1911. The primary purpose of these loans was to attract settlers, to protect the southern borders and to supply the rapidly developing urban centers with food. These loans eventually became grants.

Several credit institutions were set up during the colonial period [Mabi, 1974; Mbuyi, 1970]. Their main purpose was to attract white settlers. The loans given were practically grants. Gradually, credit institutions evolved into true credit granting agencies, but the credit terms were too strict in relation to guarantees or collateral to appeal to indigenous farmers and, thus, they served primarily the white community.

In 1941 the "Fonds Spécial du Crédit Agricole Indigéne" was set up specifically for indigenous farmers and their local collectivities. Other governmental financial institutions were created later for the same purpose but they had only a limited success. They granted credit only to those who could offer material guarantees and many recipients confused a loan with a grant. Private banks catered only to capital intensive, commercial plantations.

The amount of agricultural credit given to smallholders from 1960 to 1970 was insigificant. USAID helped to constitute a "Fonds Congo" which worked through private banks, primarily for the rehabilitation of abandoned plantations. On March 2, 1967 the "Fonds National de Crédit Agricole et Artisanal" (FNCA) was created, absorbing "Fonds Congo" and other credit institutions established during the colonial period. These institutions had a limited impact on agricultural production; lack of loan supervision, political interference and poor management greatly reduced their efficiency. CADEZA (Caisse Générale d'Epargne du Zaire), the national savings and loan institution, had on December 31, 1969 only 0.26 percent of its outstanding loans in agriculture [Vasos, 1973]. In 1970 two new financial institutions were created, SOFIDE and Supervised Agricultural Credit (Crédit Agricole Contrôlé).

SOFIDE (Société Financière de Développement) was set up with aid from the World Bank. From the date of its creation to June 30, 1972, only 2.2 percent of its credit was channeled into agriculture although this institution accounted for 70 percent of all credit granted over this period by specialized financial institutions [Mabi, 1974].

The Supervised Agricultural Credit project was financed largely by counterpart funds from USAID. The long term objective of this project was to prepare the ground for the establishment of a national agricultural credit bank. Originally, 500,000Z was budgeted for this project. It was decided to grant loans to individual farmers, to cooperatives, paysannats, small agricultural businesses and small agricultural marketing firms. In fact, a consultant for the project recommended lending for marketing projects as they were the most creditworthy, and he strongly urged lending to cooperatives rather than lending through cooperatives for production credit [Hirsch, 1970]. Moreover, he recommended that lending to individual borrowers only be allowed in exceptional circumstances. Three types of loans were made available: short-term loans, up to 24 months, interest rate 11 percent; medium-term loans, from 25 to 60 months, rate 8 percent; and long-term loans, from 61 to 120 months, rate 6 percent. The funds were disbursed in installments. The short-term loans were to be repaid with the proceeds from the sale of agricultural products and the medium- and long-term loans were repaid in annual annuities. The recipients needed to have 20 percent of the required capital on hand in order to become eligible for a loan.

A central loan committee decided on all loan applications. However, cooperation from private banks in administering the loans was not forthcoming. Originally, four areas were selected for inclusion in the project: the Kinshasa area, the Mbanza-Ngungu area (ex-Thysville), the Bumba area and the Gandajika area. The Bunba area, the major rice production center in Zaire, was dropped before the project started pending a change in the pricing structure of rice. The Gandajika area was also dropped temporarily.

The project management was composed of an expatriate project leader, sponsored by USAID, eleven expatriate supervisors from I.V.S. (International Voluntary Services, Inc.) and an equivalent number of Zairean counterparts. Technical assistance to farmers was an integral part of the project and was the major responsiblity of the I.V.S. people and their counterparts. The project was fairly successful as compared with previous agricultural credit schemes. Of the 71 loan applications received by December 31, 1971, 41 were approved and 83, 626Z was disbursed, on the average 2,260Z per recipient [IVS, 1972]. About 55 percent of the loans were for operating expenses and 45 percent were for investments. All production loans were made to middle class farmers, rather than the small farmers for which the program was originally designed.

In December 1971 USAID discontinued technical assistance to the project and reduced by one-third the amount of loan funds for the project.[15] Hence, the project had not been operational long enough to

[15]This coincided with the arrival of a new food and agriculture officer in USAID/Kinshasa.

test the feasibility of agricultural credit. It was too early to evaluate the rate of reimbursement, but the prospects for repayment were very good according to the IVS staff. Loan recipients did increase their agricultural production and their incomes. The project was turned over completely to the Zaire government on December 31, 1971. Part of the funds were transferred to the National Maize Program (P.N.M.), and all external support was cut off. Mabi [1974] indicates that the operations were suspended because of poor repayments. Thus, what started out as a unique experience in agricultural credit in Zaire was aborted for reasons which are unknown to the author.

At present, there is no specialized agricultural credit institution now functioning in Zaire. Private banks continue to play a major role in channeling credit to commercial plantations and agricultural marketing firms. In December 1970 33 percent of the loans administered by private banks were for agricultural firms; on June 30, 1972 the percentage had dropped to 24 percent [Mabi, 1974].

The national bank of Zaire regulates the credit activities of private banks. Since July 3, 1972 credit ceilings for agriculture have been abolished and loans to agricultural firms no longer need to be covered by deposits or other collateral. And since February 1, 1974 commercial agricultural credit benefits from the lowest interest rates charged by private banks. Moreover, discount rates of commerical paper at the national bank are now fixed at 3 percent for agricultural credit, at 5.5 percent for credit for small and medium sized enterprises and at 10 percent for other firms. Each bank has a minimum quota for credit which it has to lend to agriculture and to small and medium sized enterprises. Failure to reach this quota results in requirements for covering loans with reserves for at least 40 percent of the value, depending on the deficit which they run vis-a-vis the quota. Thus, the government via the national bank is pressuring private banks to lend money for agricultural purposes and for small and medium sized enterprises.

An agricultural development bank, SOFIDAG (Société Financiére de Développement Agricole), was created in 1974 as a subsidiary of SOFIDE. Its operations have not yet started and it is doubtful whether this bank will cater to smallholders.

Small amounts of credit are provided in kind and repayment in kind is made at harvest in several agricultural development projects such as the FED-CAK project in Eastern Kasai, the FIWA-BILI project of the Belgian Aid Mission, the C.D.I. project in Bwamanda, the G.E.R. Mechanization project in Lower Zaire, the Chinese agricultural development projects in Mawunzi, Bumba and Ruzizi Valley, a.o.

In financing cotton marketing operations for farmers and in providing extension services to cotton farmers, particularly the treatment of cotton fields with pesticides-free of charge, ONAFITEX is indirectly providing credit to cotton farmers. This credit is covered by the difference between the final sales value of cotton lint and by-products and the price paid to the farmers after deductions of all marketing and processing costs. The long-run aim of ONAFITEX is to help develop cotton farmer cooperatives capable of assuming responsibility for cotton marketing operations. The role of ONAFITEX will be limited to technical assistance, auditing of accounts, agricultural extension and probably guaranteeing loans to cotton cooperatives and cotton farmers. At present, no efforts are made by ONAFITEX to establish cotton cooperatives.

If a cotton production development program is enacted, it is likely that ONAFITEX will assume the role of credit retailer and will provide the cotton extension services. ONAFITEX is already trying to consolidate all cotton extension efforts within its organization. If cooperatives are formed at a later stage, they will probably deal directly with the specialized credit institutions and ONAFITEX will then provide the needed guarantees [Mabi, 1974].

The political bureau of Zaire recently decided to create an agricultural bank to encourage the development of a "Fonds Agricole" which has just been created by the Executive Council to facilitate investments in agriculture [Zaire, 1975]. Thus, agricultural credit is now receiving major policy attention.

The Administration of Agricultural Credit and Cooperatives

It is important that the objectives of any agricultural credit project are made clear. This was a major shortcoming of the Supervised Agricultural Credit project. This project, although operating with its own extension service, was not related to a broader development program. A new technological package was introduced to farmers. The project was a general purpose project, credit for its own sake, aimed at increasing agricultural production across the board. This was probably the main reason for termination of the project.

Recipients of credit need to realize the distinction between a loan and a grant. Indeed, there is a long colonial history of confusion between loans and grants in Zaire. It is difficult to convince farmers of the exact nature of a loan, particularly when credit is given in kind and when a government institution is involved. Therefore, credit institutions need to be separated from government or para-statal institutions. The requirement of adequate guarantees (collateral) helps to make clear the exact nature of a loan but, at the same time excludes most smallholders. One long-run aim of extension education should be that of helping farmers use credit properly.

Financial profitability of the operation for which credit is given is the key to repayment. All experts agree on this point. Therefore, adequate market outlets for the increased production must exist. Thus, it is sometimes necessary to tie credit for the development of marketing facilities to production credit. In order to assure financial profitability and repayment, it is usually necessary to include an agricultural extension service in an agricultural credit project. It is not clear whether or not the extension service should be made responsible for the supervision and administration of the loans. Some argue for a distinction between credit institutions and the extension service; others give examples where the two have been merged with success [Verhaegen, 1970a].

Isolated agricultural credit projects such as Supervised Agricultural Credit probably failed because of the limited role which credit played in increasing the productivity of farmers: no new technologies of production were diffused and the performance of the marketing system was basically unaltered. Thus, credit must be part of a package of improved inputs which raises productivity of farmers and substantially increases their production and incomes.

Cooperatives are often a recommended institutional mechanism for administering agricultural credit. The historical record of farmer cooperatives in Zaire is one of failure. Cooperatives were well developed before 1960 but were strictly supervised and controlled by the government. After 1960 most cooperatives withered. Most are still officially recognized but show little or no activity.[16] Some marketing cooperatives are playing a useful role in assuring a market outlet for farmers and in supplying them with small farm tools, DDT, etc.[17]

Only 21.4 percent of the farmers in the farm business survey expressed an interest in joining a cotton cooperative and only 23.8 percent of the farmers would agree to join a collective field if asked to do so.

Several conditions are necessary for the success of cooperatives. Father A. Cauwe [1969], founder of the Kisantu cooperative, has discussed these conditions at length. Cooperatives must build upon native traditions [Hirsch, 1971]. This is probably the main reason why cooperatives created during the colonial period failed after independence. According to Hirsch [1971], "Africa does not need to take over European and American models of cooperatives without examination but rather a significant contribution could be made to agricultural and industrial development through modernizing the indigenous cooperative societies." This is also the main thrust of the government's "second revolution" based on the philosophy of authenticity [Zaire, 1975].

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[16] Hirsch [1971] listed 91 agricultural cooperatives in Zaire.

[17] For instance, the cooperative of the Turumbus in Yangambi.

In its meetings of December 28-30, 1974 the political bureau of Zaire decided to create a new type of cooperative for the production and marketing of agricultural products [Zaire, 1975]. It was also decided to create "brigades d'encadrement agricole," or brigades for agricultural extension. Thus, cooperatives will be created from the top down with the danger of creating bureaucratic institutions which are overstaffed and carry heavy overhead costs. The challenge for the Zairean government is to conceive and to promote cooperatives or other forms of organization which are socially acceptable and which build upon the traditions of people and provide farmers with incentives and the means for increased production, incomes and employment. However, not everything should be supplied by the government as this would again lead to paternalism. Instead emphasis should be on appropriate education for farmers. The chances of cooperative success also depend very much on the quality of managerial and educational staff. Individual farmers will always judge cooperatives in terms of how they will help to improve their material welfare [Hyden, 1970]. The next decade will undoubtedly see an intensive search for and selection of new forms of institutional organization for traditional farmers.

Conclusion

Most agricultural credit schemes in Africa have failed. In the farm business survey, we found no indications that lack of agricultural credit at the farm level was a major constraint on cotton production. Within the present administrative capacity of Zaire and looking at the historical record of farmer cooperatives, it is doubtful that agricultural credit could be profitable for increasing cotton production, particularly since there is not an improved package of inputs or the required extension service for introducing package programs. There is some scope for agricultural credit to enable farmers to buy insecticides and hand powered dusters or sprayers but subsidization of these inputs to promote introduction is a more effective strategy than setting up a special credit program.

CHAPTER X

SUMMARY, POLICY PRESCRIPTIONS FOR INCREASING PRODUCTION AND FOR IMPROVING THE MARKETING PERFORMANCE OF THE COTTON SUB-SECTOR OF NORTHERN ZAIRE AND FUTURE RESEARCH NEEDS

Summary

Before independence in 1959 about 800,000 families cultivated cotton in Zaire, producing 63,000 tons of cotton fiber of which 53,000 tons were exported and 10,000 tons were absorbed by domestic mills. By 1965, however, seed cotton production amounted only to 10 percent of the 1959 level and from 1965 to 1968, Zaire had to import cotton lint to supply the expanding domestic textile industry. In 1969, with the return of security and stability, seed cotton production started increasing and is now around 22,000 tons of fiber and about 6,000 tons are exported. New mills are coming into production and will soon absorb all of the domestic production.

An increase in cotton production is a high priority for the government, because of growing internal demand and good export prospects. Cotton and coffee are important cash crops produced by smallholders. However, the coffee export quota has been reached and the government now wants to promote crop diversification in the main coffee growing areas which also overlap with the main cotton producing regions.

In order to provide the cotton marketing office and the Department of Agriculture with relevant data and with prescriptions for increasing cotton production and for improving marketing efficiency, an economic analysis was undertaken of the northern cotton belt.

In Chapter II, the agricultural economy of Zaire was reviewed. Agriculture in Zaire is dualistic and traditional agriculture has been neglected. Shortage of qualified staff and lack of an adequate transport infrastructure for both the supply of inputs and the evacuation of produce are major constraints on a rapid increase in production. Marketing margins are high and production incentives for farmers are low. The government has recently created parastatal marketing offices for most agricultural products and has taken over all plantations, ranches, farms and agro-industrial complexes previously held by foreigners. The Zaire government has now declared agriculture the "priority of the priorities" and is focusing major attention on agricultural development although this is not yet reflected in the government budget. For example, in 1972 less than 3 percent of total government expenditures were allocated to agriculture.

A description of cotton production in northern Zaire is covered in Chapter III. Cotton was introduced in Zaire in 1918 as a required crop and it remained an imposed crop ever since. During the colonial period an intensive agricultural extension network promoted cotton production, particularly in paysannats where cotton was the principal cash crop. Since independence, extension agents have not been retrained; they lack travel facilities, and are insufficiently motivated. Presently, the extension service is largely ineffective. The agricultural calendar is poorly observed, seeding is retarded, fallow periods are too short and many cotton fields are poorly maintained. Three different agencies are now responsible for cotton extension work. The agricultural service of ONAFITEX now has its own extension agents who introduced large scale pesticide treatments on farmers' fields in 1972.

Since colonial times there has always been a uniform seed cotton price paid to farmers in Zaire. In 1970 the price of seed cotton paid to producers was the lowest of all African countries for which price data could be obtained. Presently, three cotton production projects are underway in Zaire: (1) the FED-CAK project in eastern Kasai, an integrated "paysannat" development scheme using improved seeds, fertilizers, pesticides, credit, tractor mechanization and improved hand tools. The project is exceeding its production objectives for cotton and food crops. It is not clear whether the project will become self sustaining by 1978, the target date. (2) The CFDT project in Ubangi-Mongala which has as its broad objective the development of cotton production mainly through improved agricultural extension services to small farmers. Presently, this project is engaged in varying research activities which are basically the domain of INERA. (3) the FIWA-BILI project of the Belgian Aid Mission in northern Ubangi which is concentrating on tractor mechanization and pesticide applications in cotton fields. The main problem with this project is its lack of focus.

Ecological conditions in the North are well adapted to cotton production. Soils in the Uélés are generally better than those in Ubangi-Mongala. Land tenure is no constraint on cotton production. The cultural practices used by farmers are primitive and very labor intensive. The only source of power is human labor.

The population in Ubangi and Mongala sub-regions is increasing at a rapid pace but several zones in the Haut-Zaire region have low to negative rates of population growth.

The northern cotton belt has gained in importance relative to the southern zone since 1960. The Ubangi sub-region now contributes 19.0 percent of the total cotton production in Zaire as contrasted with 9.6 percent in 1959. The decrease in cotton production in the Equator region since 1959 is almost completely attributable to a reduction in the Mongala sub-region where production is now only about one-fourth of the 1959 level. Cotton production fell relatively more in the Uélés than in Ubangi-Mongala. The potential for increasing cotton production in the Uélés is much larger than that in Ubangi-Mongala.

Cotton marketing and processing are discussed in Chapter IV. In 1971, a national cotton marketing office (ONAFITEX) was created as a major step toward rationalizing the cotton marketing structure in Zaire. Until then, conventions with foreign controlled private cotton ginning firms regulated cotton processing and marketing on a custom work basis. This approach resulted in generous profit margins being accrued by the ginners. By 1970 the reserves of COGERCO, the price stabilization fund and regulatory agency, were exhausted and this prompted the government to intervene and establish ONAFITEX.

In 1970 half of the 115 ginning plants in Zaire were closed. Although sufficient ginning capacity is presently available, thirty new ginneries are now being installed in Zaire. Technically ginning has not been a bottleneck in cotton processing and there does not appear to be an economic justification for the government's purchase of the new ginneries.

Cotton marketing costs are very high. Transport costs represented one-fourth of total marketing costs, including the purchase of seed cotton in 1969 and they were much higher for the Uélés than for Ubangi-Mongala. Transport costs are very high because of the poor roads, the long distances involved in hauling seed cotton and the luxury goods rate charged by ONATRA and VICI-ZAIRE for the transport of cotton bales.

ONAFITEX has reduced marketing costs by laying off expatriate personnel, and by reducing transport rates, financing and baling costs. However, the collection of seed cotton in 1973 and 1974 started late and was extended over much of the year. This reduced the farmer's willingness to plant cotton; it occupied collection agents, many of whom are cotton extension workers, for a long time on collection; and it increased transport costs.

The Zairean textile industry is well developed. A large textile mill is now going into production in Kisangani and this will considerably improve the marketing efficiency of cotton from the Uélés. The average sale prices of cotton fiber to domestic textile factories remained remarkably stable over the 1963-1973 decade. Presently, local fiber prices are kept low to protect the Zairean textile industry and Zairean consumers. In 1973-1974 fiber prices were about half of the export price. The prospects for expansion of the domestic market for locally made textiles are bright because of the high income elasticity of demand for cotton.

The cottonseed crushing industry is well developed but suffers from outmoded equipment and high transport costs. Since 1960 most mills have been operating in the red. In 1973 most cotton seeds in the North were either burned or dumped; some were exported. A high capacity oil extraction mill is being opened in Gemena in Ubangi and will process all the seeds from Ubangi-Mongala and probably some from the Uélés.

Chapter V focuses on the methods of primary data collection on cotton farms in northern Zaire. A farm business survey was conducted of 160 cotton farmers selected at random, with two visits per farm, once before harvest and once after. Four field enumerators were hired to interview farmers. This survey was supplemented with visits to the ginning mills, to the regional branch offices of ONAFITEX and to the central headquarters in Kinshasa.

The farm business survey data are presented and analyzed in Chapter VI. The average age of the farmers was 44 years. The average years of formal schooling was 1.4. Almost half of the farmers had been employed off their farm in some way in the past. Each family was composed of 5.05 persons. Maize and manioc were the most important food staples in the North-West and manioc and bananas in the North-East. Land tenure did not appear to be a problem. On the average, 86.0 percent of the farmers were under obligation to grow cotton. The average acreage imposed was about half a hectare. Stiff fines and/or jail terms were given to farmers who ignored cotton growing requirements.

Since farmers were only interviewed twice it was not possible to collect accurate labor data. Communal labor was fairly common. Most farmers had to help repair the roads which pass through their villages, for an average duration of 6.7 weeks per year. About half of the farmers also had to work for the chief of the village or head of the clan for an average of 10.5 weeks. These activities interfered with their cotton operations.

Most farmers possessed only a few elementary hand tools such as a machete, hoe and axe. Chemical fertilizers were unknown to all cotton farmers interviewed. Some farmers (12.9 percent) complained that they had received cotton seeds too late. Fields were planted one to three weeks after the optimal time of planting. The recommended crop rotations were generally observed although cotton was almost never grown in a pure stand. Fallow time was on the average 6.5 years, far below the recommended period of 10-20 years. Cotton fields were located on an average of 1.9 km. from the compound of the farmer. Only 19.2 percent of the cotton fields were grouped in large blocs. Only about one-third of the farmers decided where to locate their cotton fields and only one-tenth determined the size of their cotton fields. Agricultural monitors and to a lesser degree territorial agronomists and village or clan authorities were primarily responsible for determining the location and size of cotton fields.

The average cotton acreage per farm was small: 35.7 ares, less than one acre. There was a large variation in the size of cotton fields between farms. The average farm size was 83.0 ares; 113.6 ares in Ubangi-Mongala, 34.3 ares in Bas-Uélé and 53.7 ares in Haut-Uélé. The largest cotton fields and the largest number of fields per farm were in Ubangi-Mongala.

Cotton plant densities were fairly uniform but well below the recommended density. Cotton maintenance was generally poor and farmers harvested too late. The average yield per farm in kg. per hectare was 399 kg. (257 kg.in Ubangi-Mongala, 687 kg. in Bas-Uélé and 436 kg. in Haut-Uélé). Yields differed widely between farms and between subregions. Yields in Bas-Uélé were more than double those in Ubangi-Mongala. Gross revenues from cotton in Bas-Uélé were also more than double those in Ubangi-Mongala or Haut-Uélé. On the average, farmers earned a gross revenue of 8.79Z (17.58$) from cotton production.

Most farmers learned about the cotton price on the day of sale or only a few days before. Farmers interviewed did not know the weight of seed cotton they brought to the collection center.

The majority of the farmers (67.7 percent) affirmed that the producer price over the last five years had influenced their decision to plant more or less cotton. Farmers thought that the present cotton prices were too low as farmers reported that the price would have to be raised substantially before they would increase their acreage; on the other hand, farmers reported that prices would have to fall considerably before they would reduce their cotton acreage. At present cotton prices farmers are insensitive to small price changes. Farmers in the Uélés were much more sensitive to price changes than those in Ubangi-Mongala. About half of the farmers believed that cotton production earned them a lot of money but 96.1 percent also considered cotton a risky crop. Only one-fifth of the farmers expressed an interest in joining a sales cooperative for cotton.

Of the farmers interviewed, 87.5 percent knew an agricultural monitor (extension agent). The territorial agronomist was less known by the farmers. Generally, the farmers believed that the help of agricultural monitors and the territorial agronomist was needed to produce more cotton.

Cotton was ranked as the first source of sales revenue by 42 percent of the farmers; 23 percent also ranked cotton as the second most important source. For 18 percent of the farmers, coffee was the first source. Cotton was by far the primary source in Bas-Uélé and coffee was more important in Ubangi-Mongala.

Farmers paid an average head tax of 2.47Z per year as well as other taxes. The dowry represented a considerable outlay of money relative to the farmer's income; the average cash portion of the dowry was 34.8Z.

Most farmers like to grow cotton for the cash income it provides. However, they complained about the low seed cotton price and the small amount of money they earn with cotton. They consider poor health as a major constraint on their ability to produce more cotton. The lack of incentives and the problems connected with the delayed purchase of their cotton are given as other important factors for giving up cotton production. They expect the government to raise cotton prices and to provide farm tools, machinery and gifts as incentives to expand production.

In Chapter VII we analyzed the returns to labor in cotton production using labor data derived from agricultural experiment stations. We found that the returns to labor in cotton production are comparable with those for food crops. These returns are below the legal minimum wage of unskilled workers in rural areas. Perennial crops earn much higher returns to labor than cotton, with cocoa the most profitable crop followed by coffee and oil palm. These returns are well above the legal minimum wage.

In December 1973 the real purchasing power of seed cotton was about half of the June 1960 level. Thus, other things being equal, the real returns to labor for cotton production are now much below those of 1960. This author strongly believes that erosion of the farmers' real purchasing power of seed cotton explains a large part of the lack of interest in cotton production, low yields and the present low level of production. Presently, cotton farmers can derive much higher labor earnings per day from other crops than cotton, particularly coffee, which has expanded greatly among smallholders since 1965. Maize and paddy can also be more profitable if there is an assured market outlet at the official minimum purchase price.

Chapter VIII contains an analysis of the factors explaining cotton production. A multiple linear regression equation model was used to explain the variation in yields between farms. For the northern cotton belt, a coefficient of multiple determination (R^2) of 0.58 was obtained and the dummy variable for Bas-Uélé turned out to be the most important factor. Other important variables with a positive effect were cotton revenues, the distance from the house to the field, cotton plant density, imposition of other crops than cotton, labor performed on other activities than maintenance and labor units available on the farm. The only variable with a negative effect was the dummy variable for the Mongala sub-region.

In the analysis of factors explaining acreages, an attempt was made to determine the price elasticity of supply in terms of acreages planted. The results do not confirm our hypothesis of a positive nominal price effect. The following factors probably influenced the unexpected outcome of our supply response analysis: the real cotton price remained almost constant over the 1970-1972 period, the 1970 acreage data could have been inaccurate and other things may not have remained equal over the time period considered.

A multiple linear regression statistical analysis was carried out to explain the variations in cotton acreages between farms. The coefficients of multiple determination obtained in this analysis were below those for the analysis of yields. For the North, one-half of the variance in cotton acreages was explained in terms of the variance of eight other variables ($R^2 = 0.50$). Two dummy variables are included in the equation, one for Ubangi and one for Mongala, reflecting the major differences between sub-regions. The most important variables were acreage in other crops, particularly in Ubangi-Mongala, and years of fallow, particularly in the Uélés. Both variables had a positive effect on cotton acreages. Another variable with a positive effect was work for chiefs and other authorities. Variables with a negative influence on cotton acreages were the labor inputs per hectare in cotton production with labor for cotton maintenance having a stronger negative effect than labor for other cotton activities.

A comparison of the cotton production determinants between 1958-1959 and 1970-1971 using official government data revealed that production in 1971 in Ubangi was at the 1959 level but that the increase in the number of cotton farmers and in total acreage were offset by a large decrease in yields per farm in kg. per hectare. For Mongala, production dropped 68 percent as a result of a decrease in number of cotton farmers, a large decrease in the acreage per farm and an even larger decrease in yields per farm in kg. per hectare. In Bas-Uélé the number of cotton farmers, the average acreage per farm and the yield per farm in kg. per hectare decreased all in the same degree, about 40 percent and accounted for the large drop in production, 77.7 percent. In Haut-Uélé the same picture was repeated but the decline in yields was much larger, 73.1 percent,while production fell by 81.5 percent.

A comparison of the cotton production determinants derived from the farm business survey with the 1970-1971 official data gave almost identical data for Ubangi-Mongala but marked differences for the Uélés, except for the acreage data. Yields in kg. per hectare for the Uélés in 1973 were at the 1959 level, somewhat higher for Bas-Uélé and somewhat lower for Haut-Uélé. This contrasts with the official 1971 data which showed a sharp decline in yields since 1959. As a result, this author questions the 1970-1971 yield data for the Uélés. According to the 1972-1973 farm business survey data, the low level of cotton production relative to 1959 can be explained only in terms of a decrease in acreage per farm and a large decrease in the number of cotton farmers in the Uélés.

In Chapter IX alternative strategies for increasing cotton production in the North were analyzed and evaluated. First, the barriers to improving the performance of the cotton subsector in northern Zaire were listed. Then, the strategies for increasing cotton production were examined within the context of increasing regional commodity specialization within northern Zaire and in a political economy framework of developing the North.

In the immediate future, the most promising avenues for expanding cotton production are a revision of cotton pricing policies, diffusion of improved agronomic practices, an overhaul of the cotton extension service, a pilot cotton development project in Bas-Uélé and accelerated research on new varieties.

A substantial increase in the seed cotton price from 6.5 Makuta to 10.0 Makuta per kg. for the first grade seed cotton is needed to provide adequate incentives for farmers to expand cotton production. Such an increase in the producer's price could be made possible by raising domestic cotton lint prices in relation to world market conditions. An expansion in production will, in turn, reduce per unit cotton marketing and processing costs and will provide ONAFITEX with substantial export earnings. When more favorable producer pricing policies are adopted, the cotton imposition system can be removed and the cotton extension service can gradually shift from its traditional regulatory role to an educational role.

There is a large opportunity for increasing cotton yields in northern Zaire by introducing improved agronomic practices such as timely planting and harvesting, correct spacing, frequent thinning and weeding, etc. However, a major overhaul of the cotton extension service is needed in order to create the administrative structure and leadership for effective small farmer extension programs.

The following extension reforms were recommended: retraining and upgrading of extension workers, creation of regional cotton extension committees and the establishment of an extension department at the National University of Zaire and at the National Institute for Agronomic Studies and Research.

A pilot cotton development project in Bas-Uélé, centered in Bambesa and focusing on an extension of improved agronomic practices, would have a great potential for increasing cotton production. Moreover, specialization of production in this area would substantially reduce per unit assembly, transport and ginning costs. Research on new varieties for the North needs to be accelerated and improved varieties should be imported from neighboring countries as the present variety is degenerating.

Chemical fertilizers, tractor mechanization and agricultural credit are presently less promising strategies for increasing cotton production in Northern Zaire. More technical and economic research at the farm level is needed to test alternative rates of application of fertilizers, selective mechanization, and the need for agricultural credit. When the cotton producer's price is raised and when the extension service is upgraded, these strategies may become feasible.

Zaire is a very small consumer of fertilizers with less than 1 kg. per head in Zaire as compared with over 10 kg. in most Western African countries. Fertilizer prices are very high in Zaire because of the predominately Western European origin, ocean freight, high transport charges to interior parts of Zaire at the general merchandise fare and poor delivery systems. Low product prices, lack of fertilizer response data, sociological factors and a rudimentary agricultural extension service are the other major constraints on fertilizer utilization. Zaire has recently decided to create its own fertilizer industry. The government should seriously consider the subsidization of fertilizer in order to promote its introduction among smallholders, first in pilot cotton development projects and then later among smallholders if it proves profitable.

The present approach to cotton plant protection is quite paternalistic and is modeled on the colonial experience. For long run success it is necessary that farmers themselves adopt spraying or dusting with pesticides. To favor introduction of pesticides and hand powered elements, the government should temporarily subsidize these inputs until they are in widespread use.

From 1964 to 1973, the Zairean government spent approximately 17 million dollars on the importation of heavy agricultural machinery. Tractor mechanization was tried out on a large scale in Zaire from 1950 to 1960, mainly in savannahs. The use of machinery was only justified when a substantial increase in the area under cultivation occurred. Usually cotton yields increased by 15 to 25 percent over manual land preparation. Animal powered mechanization was tried with success before independence in savannah areas of southern Zaire. Presently, animal powered mechanization has almost completely disappeared in Zaire. Tractor mechanization of cotton production in the North cannot be recommended. All mechanization projects in Zaire rely heavily on expatriate management and the economic effects of tractor mechanization have not been properly studied to justify tractor mechanization. However, the government should take steps to improve the supply of improved hand tools and equipment in rural areas of the North.

Agricultural credit schemes for smallholders in Zaire have failed because of unrealistic demands for guarantees, lack of loan supervision, political interferences, poor loan management and lack of integration with other agricultural projects. The government is now pressuring private banks to lend money for agricultural purposes. In northern Zaire, we found no indications that lack of agricultural credit at the farm level was a major constraint on cotton production. Within the present administrative capacity of Zaire and the historical record of farmer cooperatives, it is doubtful whether agricultural credit would be profitable for increasing cotton production, particularly since there is not an improved package of inputs or the required extension service for introducing package programs. Subsidization of inputs such as insecticides, hand powered dusters or sprayers, etc. is likely to be a more effective strategy to promote cotton production than setting up a special credit program.

In the remainder of this chapter, a series of recommendations are made for increasing cotton production and for improving the marketing performance of the cotton subsector of norther Zaire.

Policy Prescriptions for Increasing Production Improving the Marketing Performance of the Cotton Subsector of Northern Zaire

Revising Pricing Policies and Removing the Imposition System

Cotton pricing policies cannot be divorced from price policies for other crops and thus, pricing policies need to be designed for a cotton-food-export crop production system in relation to the production objectives for each commodity. For example, since coffee production already exceeds Zaire's quota, there are sound arguments for reducing the coffee price.

Cotton farmers definitely need stronger incentives to increase cotton production. We, therefore, recommend an increase in the domestic lint price of 15 to 20K. per kg. which will generate enough revenue to enable ONAFITEX to raise the producer price from 6.5K. to 10K. per kg. of first grade seed cotton. A price increase of 15 to 20K. per kg. of cotton lint for domestic spinners would raise the price of domestic lint to about 60 to 65K. per kg. of lint, still well below the price which they would have to pay for imports of the same grade and quality. An increase in producer prices would substantially increase cotton production, reduce per unit marketing and processing costs, provide ONAFITEX with substantial export earnings and speed up the diffusion of innovations. A substantial increase in the seed cotton price will also reduce the need for the imposition system as farmers will be motivated to produce cotton without compulsion. This will free cotton extension agents from regulatory tasks and allow them to pursue an educational function. The price increase could be both in cash and in kind. For example, many farmers cannot purchase small tools in their community and these could be made available at subsidized rates.

Diffusion of Improved Agronomic Practices and New Inputs

There is a large opportunity for increasing yields by introducing improved agronomic practices such as timely planting, thinning, weeding and harvesting, correct spacing, use of improved hand tools, etc. The cotton extension service should concentrate on the introduction and diffusion of improved agronomic practices. Demonstration plots in selected villages would be very useful in showing farmers what could be achieved.

Cotton seeds should be sorted in the ginneries and disinfected before distribution to farmers in order to improve germination rates and to assure adequate plant densities.

When cotton production becomes profitable for farmer, the government should drop spraying and dusting the farmers' fields and instead should concentrate on teaching farmers how to treat their fields with pesticides. The government should provide farmers with locally made hand powered dusters or sprayers and pesticides at a subsidized price to stimulate adoption.

Since Zaire has decided to create its own fertilizer industry, efforts should be undertaken to introduce chemical fertilizers on pilot projects and then later among smallholders if it proves profitable. However, the cost-benefit ratio of fertilizer should first be improved considerably by increasing the seed cotton price, by eliminating all import duties and taxes and by reducing the fertilizer transport rate schedules of ONATRA and other public and semi-public transport agencies. Only highly concentrated fertilizers should be imported, preferably from suppliers within Africa. Granulation, blending with inert fill and bagging should be done in Zaire. The government should seriously consider the subsidization of fertilizers in order to promote their introduction among smallholders. At the same time, an input delivery system should be set up which focuses on smallholders.

Overhauling the Cotton Extension Service

Several actions need to be taken to shift the cotton extension service from a regulatory to an educational agency. The administrative structure of agricultural extension should be reformed in order to coordinate and integrate agricultural extension efforts. Extension monitors should be placed under a single authority. Since ONAFITEX needs a cadre of well-trained cotton extension officers, it should have some influence and control over cotton extension monitors regardless of which agency has formal responsibility for the extension system.

Agricultural extension workers need to be retrained and their performance should be reviewed periodically. The function of extension agents needs to be reviewed; they should be provided with adequate transportation, facilities for field work and demonstration plots, opportunities for professional advancement and supportive personnel and services.

A cotton extension committee should be appointed in each regional branch of ONAFITEX and charged with drawing up a campaign for the next crop. Immediate steps should be taken to develop a cotton handbook which summarizes and translates the recommended cultural practices into local languages for all cotton extension agents. Each year, new cotton research results should be added to this handbook.

A department of agricultural extension should be set up at the National University of Zaire, preferably in the Faculty of Agronomy, either as a new department or added to the existing department of agricultural economics. A curriculum in agricultural extension education should be developed including courses in communications, rural sociology, farm management, agronomy and agricultural development. An extension liaison department should be created in INERA to ensure that research findings are diffused and that there is constant feedback into the research system.

Establishing a Pilot Cotton Development Project in Bas-Uélé

We recommend the establishment of a pilot cotton development project, centered in Bambesa, which focuses on extension of improved agronomic practices. The Bambesa project can be modeled after the CFDT project in Ubangi-Mongala. The CFDT project has demonstrated the importance of testing the potential of improved agronomic practices under actual farm conditions. The primary objectives of such a pilot project in Bambesa would be to increase the yields to an average of 1,000 kg. per hectare, an increase in average cotton acreage per farm to 50 ares and an increase in the number of cotton farmers. The feeder roads should be improved in the project area and provisions should be made for the ginning mills to handle the increased production. The Bambesa pilot project would foster the specialization of cotton production and would greatly reduce per unit cotton assembly, transport and ginning costs.

Technical Cotton Research

Cotton production in northern Zaire could benefit greatly from a good research program which is presently absent. The following points should be considered.

<u>Research on Improved Varieties</u>

As soon as adequate and competent staff can be found, the research station in Bambesa should be geared up for cotton breeding and selection for the northern cotton belt. In the meantime, the Gandajika station in the South should continue its plant breeding activities, but selection of new varieties for the North should be concentrated in the northern ecological area, preferably in Bambesa. Better cooperation between the French IRCT stations in West and Central Africa, INERA in Bambesa, Boketa and Gandajika, the agricultural service of ONAFITEX and the CFDT mission in Ubangi-Mongala is desirable for restoring and maintaining the varietal purity of Reba B 50 and for gaining access to better varieties developed in other countries.

Research on Better Agronomic Practices and Improved Input Packages

Presently, INERA is concentrating almost solely on the breeding and selection of new cotton varieties. However, there are many agronomic problems which need urgent research attention before recommendations can be drawn up for the cotton extension service. Improved input packages will most likely include chemical fertilizers, pesticides, credit and selected mechanization technologies. Research is needed to determine the optimum types and rates of application of these inputs and the financial and economic returns on these packages. Since cotton is always part of a food crop rotation, the residual effects of improved inputs on food crops need to be taken into account for a proper analysis of the impact of a new cotton production technology.

The research efforts of the CFDT mission in Ubangi-Mongala are laudable and are a step in the right direction. However, their efforts are clearly not sufficient, and more rigorous trials and testing are necessary before solid recommendations can be made.

Improving the Performance of Cotton Marketing

The following points should be considered in attempting to improve the operational efficiency, vertical coordination and organization of the marketing and processing activities of ONAFITEX.

Operational Efficiency

Substantial gains in operational efficiency could be achieved by ONAFITEX through better organization and coordination. The following steps should be taken to enhance operational efficiency.

Reducing Transport Costs

- --The organization of seed cotton collection should be better organized to reduce transport costs. Half capacity runs and one-way payloads should be avoided.
- --Seed cotton collection should start in December and terminate by the end of March, allowing most cotton to be transported during the dry season. Thus, collection agents would also be able to devote more time to agricultural extension as the buying season would be shortened.
- --Standardized canvasses and large scales should be utilized to speed up the weighing and collection of seed cotton.
- --Seed cotton should be kept in the storage facilities of the collection centers when storage facilities at the ginnery are inadequate.

—Efforts should be made to obtain a more advantageous fare classification for cotton bales transported by public and semi-public transporters.

--Marginal cost pricing should be applied for the transport of cotton seeds from ginneries to crushing mills.

Reducing Ginning Costs

--The overstaffing at ginning mills should be corrected.

--More spare parts should be stocked for the repairing of gins, power sources and transport equipment to overcome undue delays in ginning and seed cotton collection.

--During the dead season all ginning and transport equipment should be overhauled.

--If necessary, two or even three work shifts should be organized in ginneries when storage facilities are inadequate to handle all incoming seed cotton.

Improving Organization and Administration

--Operational efficiency is hampered by serious communication problems between the central headquarters in Kinshasa, the regional branch offices and the ginning mills. Steps should be taken to improve communications.

--The flow of funds in appropriate denominations and quantities for the buying of seed cotton needs to be accelerated.

--the budget control and accounting system needs to be strengthened, although it should not slow down the collection and ginning of seed cotton.

Diffusion of Information

--Producer prices should be announced prior to the planting season, preferably during the distribution of cotton seeds.

--Farmers should be informed in advance of the collection date and the price they will receive for seed cotton.

--Since 7 percent of the farmers possess a radio, this media should be used to promote better agronomic practices and to inform them about the seed cotton price and the date of collection.

Rational Utilization of Cotton By-Products

Ways should be explored to utilize cotton seeds that are presently burned or wasted. Inoperative crushing mills should be studied to determine whether new crushing equipment is needed or whether the available equipment should be repaired. An overall evaluation of the cotton seed crushing potential in Zaire should be carried out to guide the government in its efforts to use cotton seeds more rationally.

Counterpart Training

ONAFITEX has hired skilled, experienced expatriates which were formerly employed by the private cotton companies. Their primary role should be one of advising and counterpart training and not of decision-making and execution as is often the case. This will ensure that their efforts and experience are not dissipated on minor activities and that a Zairean capacity for marketing and processing management is created.

Future Research Needs

The present lack of knowledge about the major constraints on cotton production and the high costs of cotton processing and marketing requires on-going farm management, marketing and macro-economic research. Communications research for agricultural extension is needed to guide the cotton extension services.

Farm Management Research on Cotton Production

This study has utilized a farm business survey approach and, as a result, allocation could not be accurately measured. A cost route survey in the major regions could yield the needed data for a detailed study of the returns to labor in cotton production as well as data on labor bottlenecks. Cost route studies will help guide the introduction of improved inputs and the design of appropriate pricing policies. The results of cost route surveys would also help in developing simple extension guidelines on the economics of producing cotton and other crops. The identification of labor bottlenecks could help identify optimal production systems, including the development of appropriate types of mechanical technology for breaking seasonal labor bottlenecks. It is recommended that such a study be organized as an integral part of pilot cotton development projects.

The FED-CAK project in Eastern Kasai merits a full farm management survey and a detailed cost-benefit study of fertilizer application, pesticide treatment, tractor mechanization and agricultural extension. However, it is uncertain whether the results obtained in Eastern Kasai are transferable to the North because population, soils, climate, cotton varieties and marketing structures vary between Eastern Kasai and the North.

Tractor mechanization in FIWA-BILI should be studied as this project is currently not generating the data needed for a rigorous economic and financial analysis of mechanization.

The CFDT team in Ubangi-Mongala should continue its research activities in order to develop general guidelines for the expansion of cotton production. However, they should adopt a more rigorous research design, including more repetitions per trial and more variation in types and rates of fertilizers applied, in order that an economic analysis of optimum types and dosages can be carried out.

Communications Research for Improving Cotton Extension and Facilitating an Information Feedback to Researchers

Communications research for cotton extension could have high pay-offs in Zaire. For example, since 7 percent of the farmers possess a radio, the radio could be tested as a method of informing farmers about cotton prices, the proper time of collection and improved agricultural practices. Communications research could direct government attention to the linkage between agricultural research, the Department of Agriculture, ONAFITEX and the cotton farmer.

Marketing Research

Marketing research could lead to substantial reduction in the cost of cotton marketing and processing. A study is needed to determine the optimum number, size and location of ginning facilities and the optimum transport routes. This could guide ONAFITEX in the purchase and location of new ginning equipment and for the organization of transport.

Macro-Economic Research

Pricing of agricultural products as well as inputs is a major area requiring policy-oriented research. Increased attention must be directed to the impact of alternative pricing policies and their impact on production, imports, exports and consumption of the major food products and cotton.

Since most developmental efforts are focused on specific agricultural projects, research is needed to identify and analyze agricultural development projects. Project analysis should draw upon the results of detailed micro research because planning from the top down has produced disappointing results. Only when a careful economic analysis of the present cotton development projects in Zaire is completed can a particular input package be recommended for introduction and diffusion by the cotton extension service.

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