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Grain Storage and Preservation in Senegal

FOOD & FEED GRAIN INSTITUTE
KANSAS STATE UNIVERSITY
MANHATTAN, KANSAS 66506

REPORT SUMMARY

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Principal Investigator: William P. Spencer, Team Leader

SUMMARY STATEMENT

The grain storage and marketing system in Senegal was reviewed with specific emphasis on the need for grain storage facilities to maintain a reserve stock of grains and a program to train Senegalese in grain storage and preservation.

At present, cereal grains that are marketed compete with peanut and peanut seed for storage space at certain times of the year. To date much of the Senegalese grain production has been consumed at the village level. However, the government is now making an effort to encourage commercialization of millet and sorghum with a price support and purchasing policy. Storage facilities for the Senegalese buying program appears to be one of its' limiting factors.

Adequate grain storage facilities for an announced goal of the Government of Senegal to establish a 200,000 to 300,000 M.T. reserve of millet and sorghum do not exist. ONCAD has proposed the construction of an additional 120,000 M.T. of storage for various locations in Senegal to consist of 1,000 and 2,000 M.T. capacity concrete block warehouses. AID is considering financing 30,000 M.T. of this capacity. Recommendations for modification in the ONCAD warehouse design were made and estimated costs of construction found comparable to cost estimates for U.S. pre-fabricated steel buildings. Advantages and disadvantages of both designs were reviewed. Even though the GOS is emphasizing bag storage warehouses, the advantages of bulk grain storage are indicated.

A comprehensive program to train Senegalese in grain storage and preservation was outlined. The program includes provision of a grain storage and preservation advisor (2 years), training of a Senegalese grain storage and preservation specialist in the U.S. (2 years) and U.S. Short Course training for ONCAD national and regional storage quality personnel. It is recommended that an in-country training team of four members be assembled in Senegal to provide training for ONCAD regional fumigators, reserve warehouse managers, central warehouse managers and secco managers.

RECOMMENDATIONS FOR GRAIN STORAGE AND PRESERVATION

IN SENEGAL

Prepared by

William P. Spencer
Donald L. Pfost
John R. Pedersen

Prepared for the
AGENCY FOR INTERNATIONAL DEVELOPMENT
UNITED STATES DEPARTMENT OF STATE
AID/ta-C-1162
Technical Assistance in Grain Storage, Processing, and Marketing
and Agri-business Development

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PREFACE

This study and report was conducted and prepared under contract AID/ta-C-1162 technical assistance in grain storage, processing and marketing and agri-business development between the Food and Feed Grain Institute, Kansas State University and the United States Agency for International Development.

USAID/Dakar, through USAID/Washington, requested that KSU supply a team to act as technical advisors to review the grain storage and marketing system in Senegal with specific emphasis on the need for grain storage facilities to maintain a reserve stock of grains and a program to train Senegalese in grain storage and preservation. The team assignment was to supply technical advice with the goal of the Mission to prepare a Project Review Paper which could ultimately lead to a loan/grant agreement with the Government of Senegal.

The team was to address the following specific issues:

1. Discuss the GOS grain stabilization policy.
2. Explain how storage elements relate to policy.
3. Describe ONCAD's system and how warehousing relates to buying, transporting and the marketing system.
4. Discuss ONCAD's ability to meet the purchase price for buying and storage of grain.
5. Evaluate other donor activity.
6. Analyze the need for additional storage in Senegal.
7. Consider the role of farm/village storage within the entire marketing system.
8. Review ONCAD engineering plans for warehouse construction and make recommendations with respect to such plans.

9. Discuss the role of private dealers in buying agricultural products from farmers and selling them to consumers.

10. Analyze the pricing structure for cereals in Senegal.

11. Review the marketing efforts of ONCAD in purchasing cereals from 1970 to date.

12. Study the grain preservation training program, considering the work of ITA in this context.

Because of the relatively short notice and the urgency of the request, regular KSU staff members were not available for positions on the team. Dr. William P. Spencer, grain marketing economist and Dr. Donald L. Pfost, grain storage engineer, both consultants and John R. Pedersen, entomologist/grain quality specialist under the KSU contract made up the team. Dr. Spencer served as team leader.

The team arrived in Dakar, Senegal on November 9 and 10, 1975 and departed November 26, 1975.

ACKNOWLEDGEMENT

The team would like to express its appreciation for the assistance supplied by the various Government of Senegal personnel, Senegalese private industry and USAID/Dakar. It is impossible to list all who assisted in our gathering of information for this study and report. The following persons were especially helpful:

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Mrs. Yvette Pierre, Secretary
Mrs. Sally Duerbeck, Secretary
Dr. Hans Peterson, USAID/Washington

List of Abbreviations

C.N.R.A.	Centre National de Recherche Agricole (National Agricultural Research Center), Government of Senegal.
FAC	Assistance and Cooperation Funds (French Assistance)
FED	European Development Funds
GOS	Government of Senegal
I.B.R.D.	International Bank for Reconstruction and Development
I.D.R.C.	International Development Research Center (Canada)
IRAT	Institut Recherches Agronomique Tropicale (Tropical Agronomy Research Institute), France.
ITA	Institut de Technologie Alimentaire - (Institute of Food Technology)
ONCAD	Office National de Coopération et d'Assistance pour le Développement - (National Cooperative and Development Assistance Office)
S.D.R.S.	(Company for Rice Development in Senegal)
SEAC	Societe d'Etudes et d'Applications Chimiques (Company for Studying and Applying Chemicals), Dakar.
SODEVA	Société de Développement et de Vulgarisation Agricole (Agricultural Development and Extension Company)

I. INTRODUCTION

The recent, severe drought has impressed the Senegalese with the need for a wide range of measures to promote increased cereals production; to provide adequate storage facilities;to assure the commercialization of the increased production;and to store buffer stocks. The principal cereal crops of Senegal are millet and rice with lesser amounts of sorghum and corn being produced. With the full implementation of current production programs, Senegal will be self-sufficient in respect to millet and sorghum in years of normal rainfall. This will require an annual production of 600,000 MT to 700,000 MT. Rice consumption averages about 300,000 MT per year and domestic production varies from 75,000 MT to 150,000 metric tons.

The GOS has responded to these needs by enacting the Food Law-program (Appendix A) which provides for measures to increase the commercialization of millet and sorghum (the basic subsistence crops in the rural areas of Senegal) including the expansion of storage capacity to be reserved explicitly for buffer stocks of millet and sorghum.

The implementing institution of this program is ONCAD. In the past ONCAD has been responsible for marketing groundnuts and minor purchases of cereals. Because of the recent priority emphasis placed upon commercialization of food grains to be implemented by ONCAD, they are currently required by law to purchase any amount of millet and sorghum offered for sale by the farmer. Currently ONCAD has 45,000 MT in storage from the previous years'

harvests. It is estimated that this year ONCAD will purchase 100,000 MT of cereals. If this is to be realized, then additional storage must be located or constructed.

All existing warehouse space is being utilized either for the 45,000 MT of grain in storage or being readied for peanut seed which is already drying in the fields. ONCAD is expected to commence purchases of peanuts on December 15. While the majority of the peanut purchases can be stored outside, the seed must be protected and thus requires warehouse space.

In order to maintain the momentum in the commercialization of food grains ONCAD has proposed the construction of an additional 120,000 MT of storage capacity. This construction is to be in 1,000 and 2,000 MT units located throughout Senegal with the exception of Dakar. The first tranche is to be for 60,000 MT capacity of which the GOS plans to construct 30,000 MT by May 1976. The plans of the units have been approved, sites located and bids received.

In order to insure ONCAD has sufficiently trained manpower to implement the expanding program of commercialization, technical assistance and training both in Senegal and the United States for managing and protection of grain stored will be needed.

Without the additional storage and trained manpower to manage the stocks, ONCAD will have to store the grain outside under marginal conditions which will result in increased losses hence making the commercialization of cereals a very costly operation.

It is doubtful if the commercialization program can withstand the probable heavy losses over several years. Hence, the economic feasibility of the commercialization program would be questionable without expansion of storage capacity.

The commercialization program with the resulting buffer stocks would benefit, in general, the total population in the event of drought and the small farmer in particular by offering a ready market and an alternative commercial crop already familiar to him.

The Government of Senegal stated marketing policy is outlined in a background paper included as Appendix B.

II. DESCRIPTION OF SENEGAL

Geography

Senegal is a former French colony, forming part of French West Africa. Senegal gained its independence from France on June 20, 1960 and separated from Mali, to the east, on August 20, 1960.

Senegal is a small coastal country situated in the western bulge of the African continent. It is a tropical country and has a land area of 196,192 square kilometers (75,750 sq. miles). Senegal is bounded by Mauritania, Mali, Guinea, Portuguese Guinea and it encircles Gambia.

Senegal is mostly rolling savannah plains with an altitude of less than 198 meters (650 feet). Higher foot hills exist in the southeast with elevations up to 500 meters (1640 feet). The north and northeastern areas are in the sahelian zone.

Senegal is divided politically into seven (7) regions as shown in Figure 1.

Climate

Senegal has a dry, warm season in the spring with temperatures rising to 40°C (104°F) in the northern sahelian zone. It has a warm, humid rainy season with a maximum duration from June to October; lesser time in the north and maximum time in the south. The average days of rainfall vary from about 30 in the north to about 100 at the southwest border. The average annual rainfall varies from about 350 mm. in the northern region to 1300-1500 mm along the southern border. Cooler weather prevails from January to March. The influence of the Atlantic Ocean results in moderation of zonal differences along the coast. Average annual rainfall is shown in Figure 2.

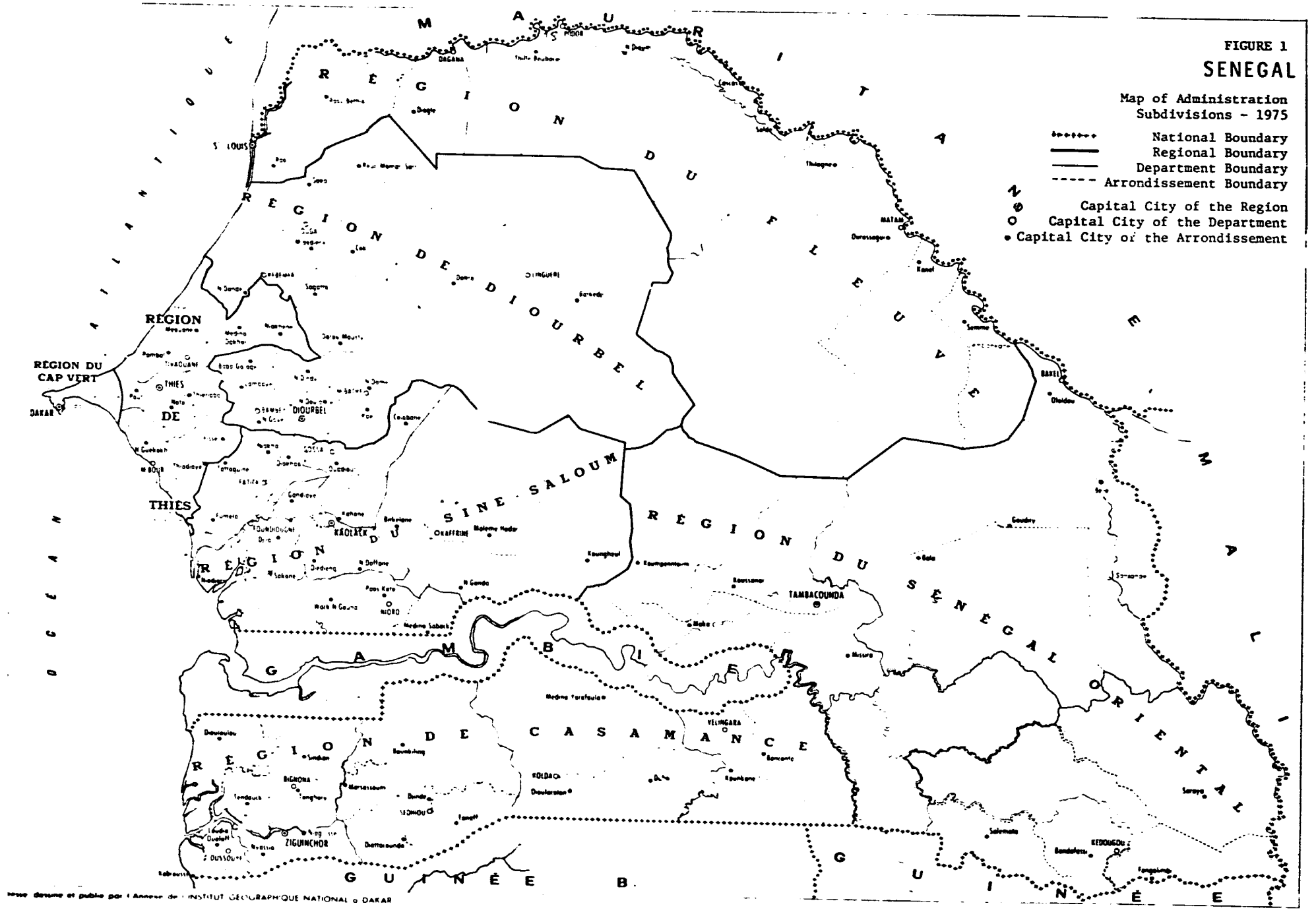
FIGURE 1
SENEGAL
Map of Administration Subdivisions - 1975
National Boundary
Regional Boundary
Department Boundary
Arrondissement Boundary
Capital City of the Region
Capital City of the Department
Capital City of the Arrondissement
OCEAN ATLANTIQUE
MAURITANIE
MALI
GUINÉE
GUINÉE B.
GAMBIE
RÉGION DU FLEUVE
RÉGION DE DIOURBEL
RÉGION DU SENEGAL ORIENTAL
RÉGION DE CASAMANCE
RÉGION DU SINE-SALOUM
RÉGION DE THIES
RÉGION DU CAP VERT
S. LOUIS
DAGANA
MATAM
BAKEL
DIOURBEL
THIES
KAOLACK
FOUNDIOUGNE
GOSSAS
FATICK
KAFFRINE
NIORO
TAMBACOUNDA
VELINGARA
KOLDA
SEDHIOU
BIGNONA
ZIGUINCHOR
KEDOUGOU
DAKAR
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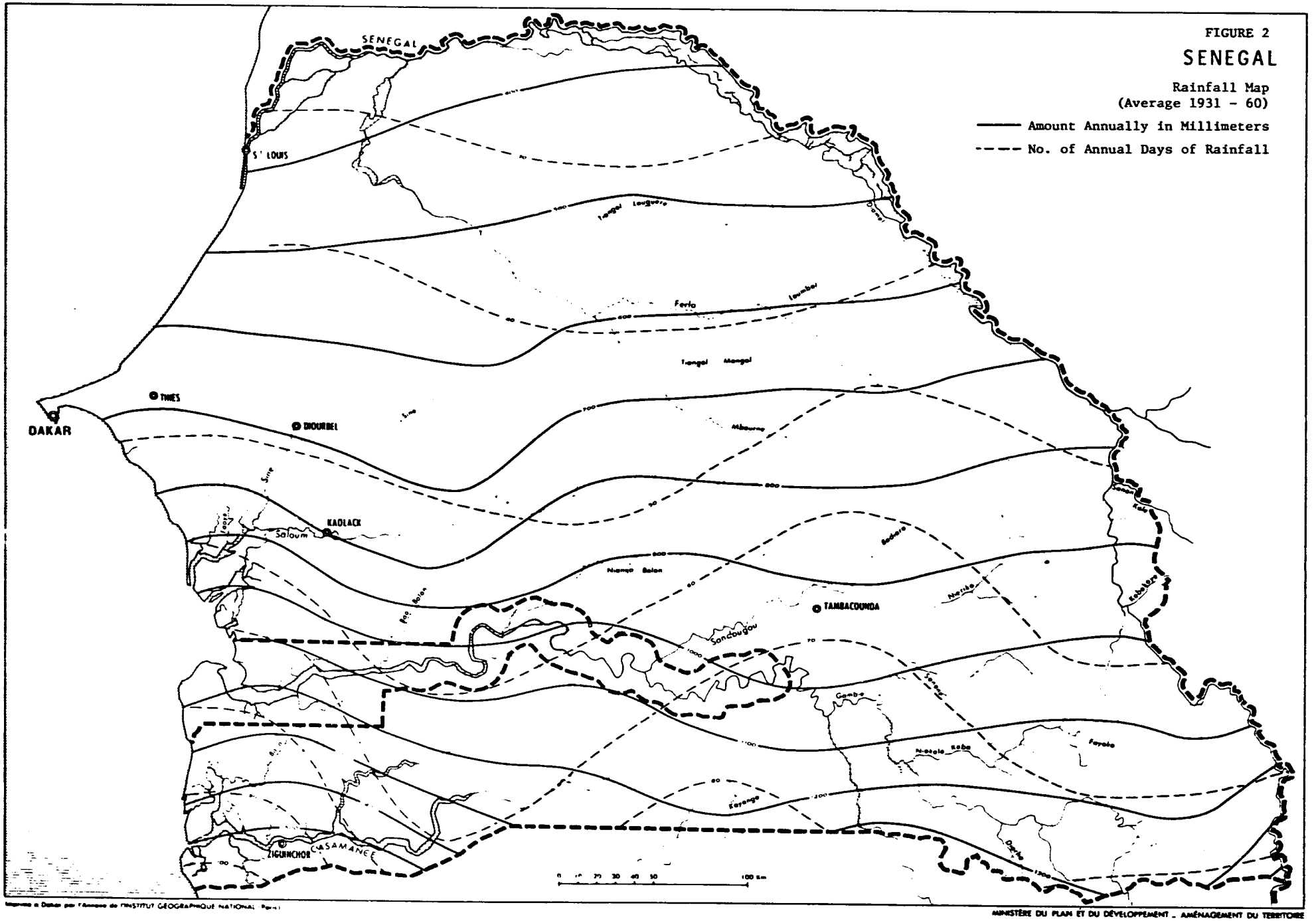
FIGURE 2

SENEGAL

Rainfall Map
(Average 1931 - 60)

——— Amount Annually in Millimeters

- - - - No. of Annual Days of Rainfall



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MINISTÈRE DU PLAN ET DU DÉVELOPPEMENT - AMÉNAGEMENT DU TERRITOIRE

Population

The estimated population of Senegal for 1974 is 4,222,803 persons with an estimated average yearly increase of 2.2 percent. Populations of the various regions are shown in Table 1. Population density is shown in Figure 3.

TABLE 1. Population of Senegal by Regions - 1974

Regions	Population
Cape Vert	804,657
Sine-Saloum	844,771
Thies	584,296
Diourbel	667,365
Fleuve	408,871
Senegal Oriental	261,942
Casamance	650,901
Total	4,222,803

Urbanization of the population is occurring at a rapid rate and unemployment is considered serious in the cities, particularly Dakar. Populations in the major urban areas are shown in Table 2. Rural Population density is shown in Figure 4.

TABLE 2. Population of the Major Urban Centers, by City

Estimate as of 1974

City	Population (in thousands)
Dakar (Metropolitan area)	714
Diourbel	39
Kaolack	106
Saint Louis	87
Tambacounda	23
Thies	98
Ziguinchor	49
Total	1,116

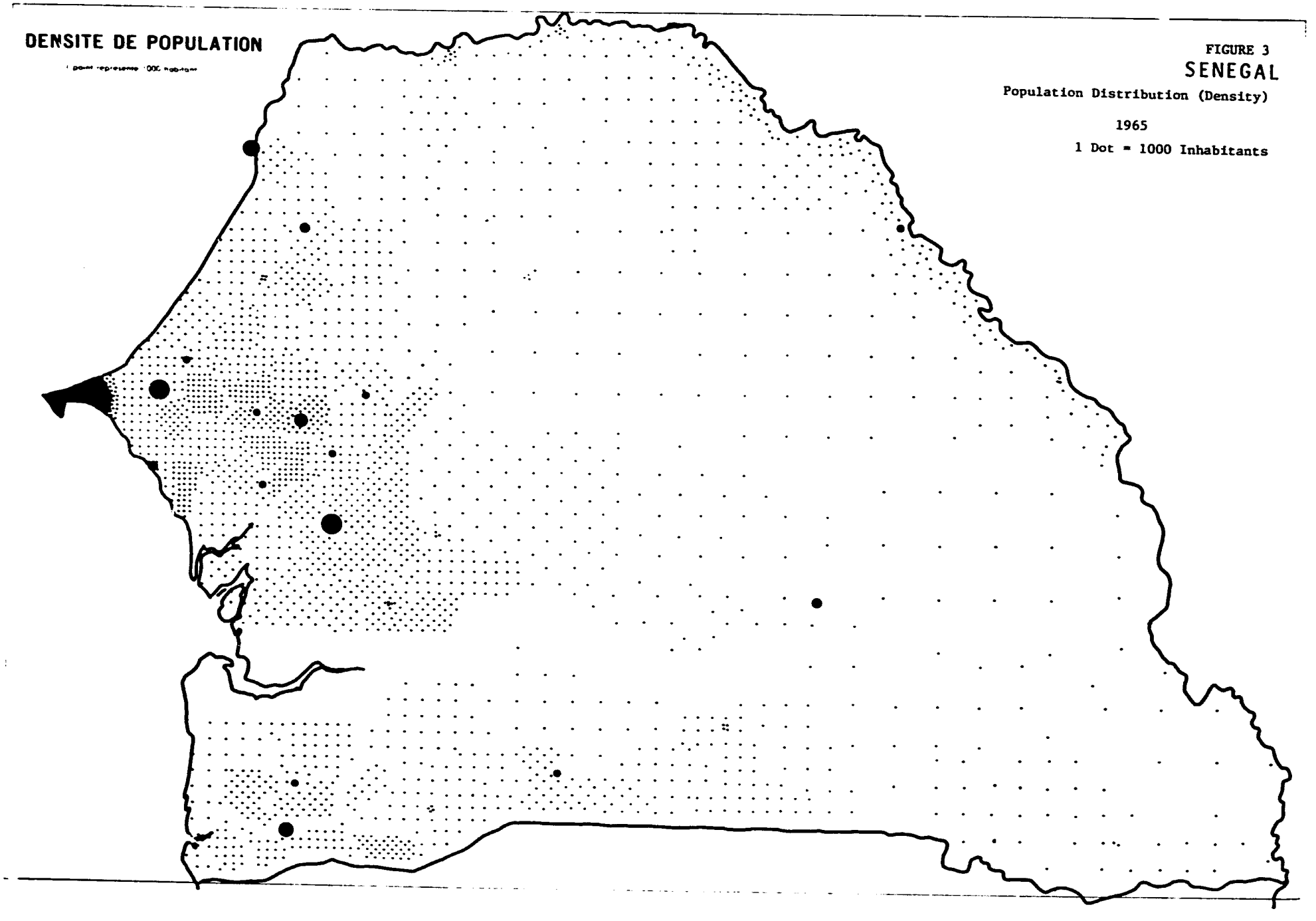


FIGURE 3

SENEGAL

Population Distribution (Density)

1965

1 Dot = 1000 Inhabitants

FIGURE 4

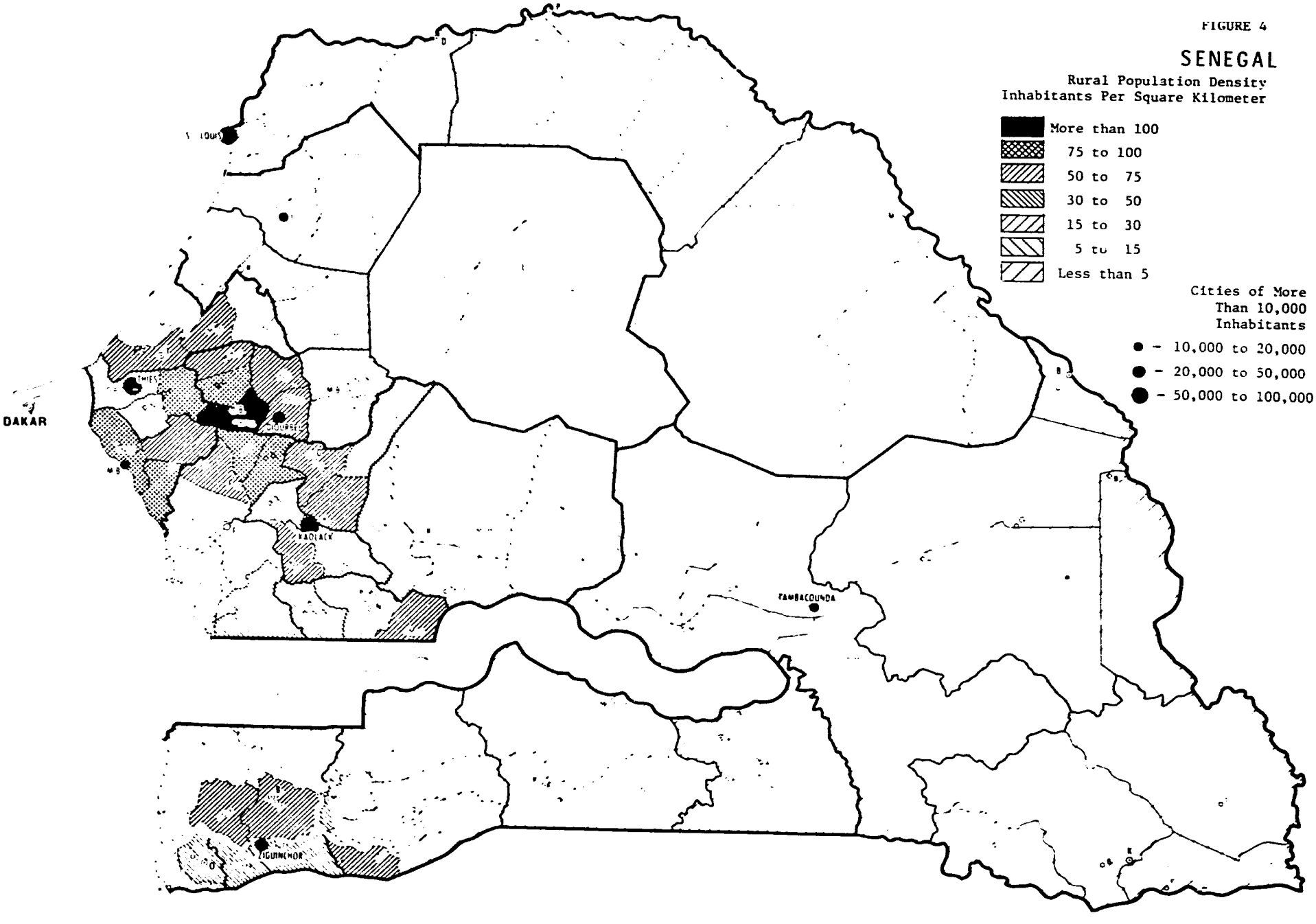
SENEGAL

Rural Population Density
Inhabitants Per Square Kilometer

- More than 100
- 75 to 100
- 50 to 75
- 30 to 50
- 15 to 30
- 5 to 15
- Less than 5

Cities of More Than 10,000 Inhabitants

- 10,000 to 20,000
- 20,000 to 50,000
- 50,000 to 100,000



Roughly 70 percent of the working force is estimated to be directly engaged in agriculture.

Education

Literacy in Senegal is estimated to be at about the 5 percent level, with most of the literate people concentrated in the urban areas.

French is the official language; however, it is primarily limited to the literate minority. Wolof is the principal tribal language spoken.

Economy

Senegal is primarily an agricultural country. Groundnut (peanut) accounts for about 50 percent of agricultural production and provides a substantial share of the country's export income.

Millet and sorghum are the principal domestic food crops. Rice is grown but far less than domestic consumption and it forms a major import.

Senegal has a large livestock population, however, efficient use of this resource has not been realized. Fishing is also an important industry and is growing.

Major industries in Senegal include phosphate mining and processing, fish processing and canning, and peanut crushing and oil refining.

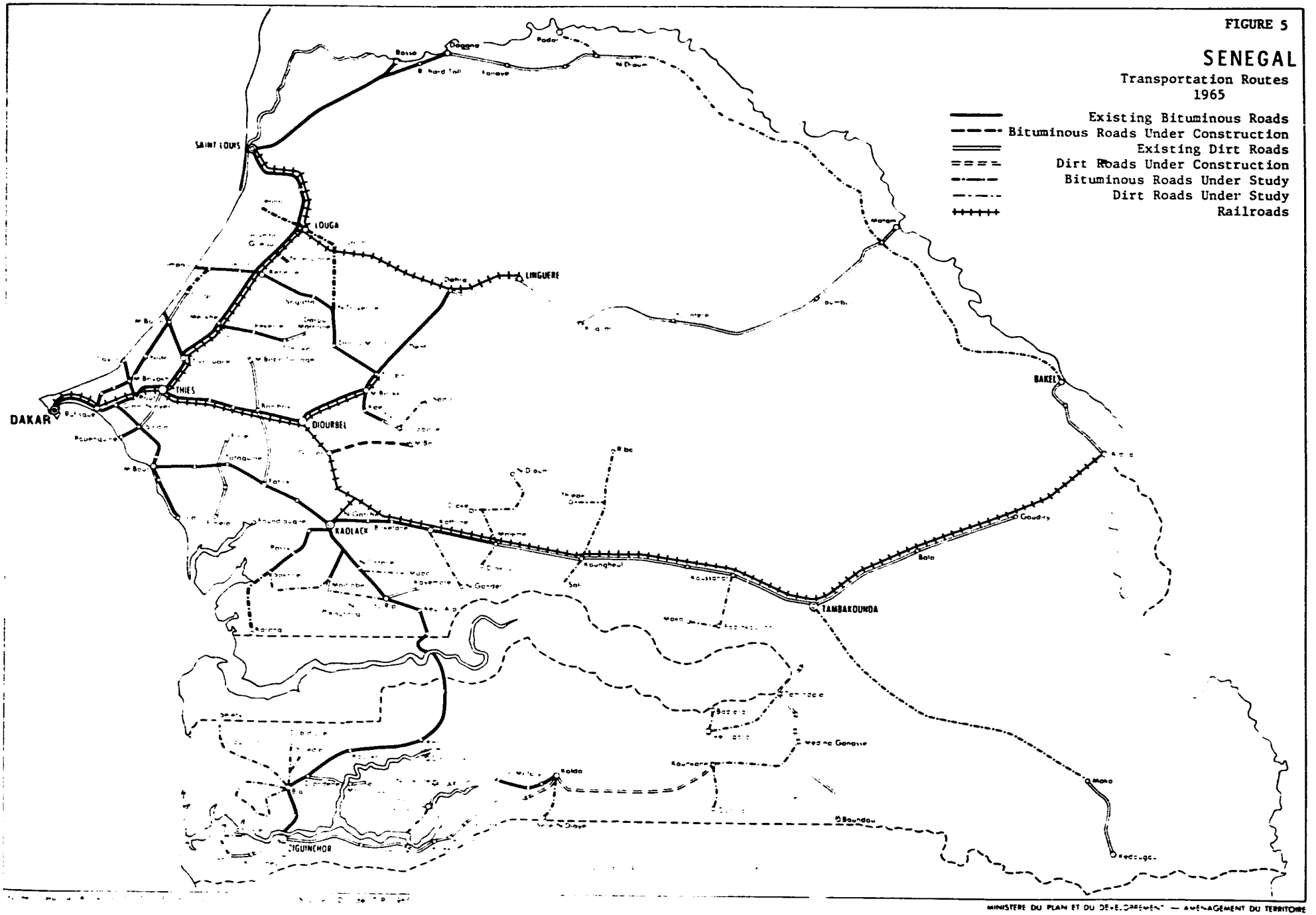
Transportation

Figure 5 illustrates the major transportation routes in Senegal.

FIGURE 5

SENEGAL

Transportation Routes
1965



MINISTERE DU PLAN ET DU DEVELOPPEMENT — AMENAGEMENT DU TERRITOIRE

III. GENERAL AGRICULTURAL SUMMARY RELATED TO GRAINS

Senegal's economy is tied very closely to its agricultural sector. Peanuts account for about 50 percent of the total agricultural production and for 60 percent of total export income.

Years prior to the drought of 1972-73, there appeared to be a lack of interest in encouraging the domestic food production of rice, millet and sorghum. Rice appears to be a popular and fast-growing staple of the Senegalese diet especially in urban areas. Rice has been grown, but in much smaller volumes than internal consumption and constitutes a major import and substantial negative factor for Senegal's balance of trade.

Since 1973, the Senegalese Government has displayed an interest in developing self-sufficiency in grain production as exemplified by the Government of Senegal's current agricultural policy. Its current policy is to promote domestic agricultural production to cope with a population growth about 2.2 percent most of which is in urban areas.

To date much of the Senegalese grain production has not been commercialized. Most of the rice, millet and sorghum is consumed in the villages where it is produced. The government is now making an effort to encourage commercialization of millet and sorghum with a price support and purchasing policy.

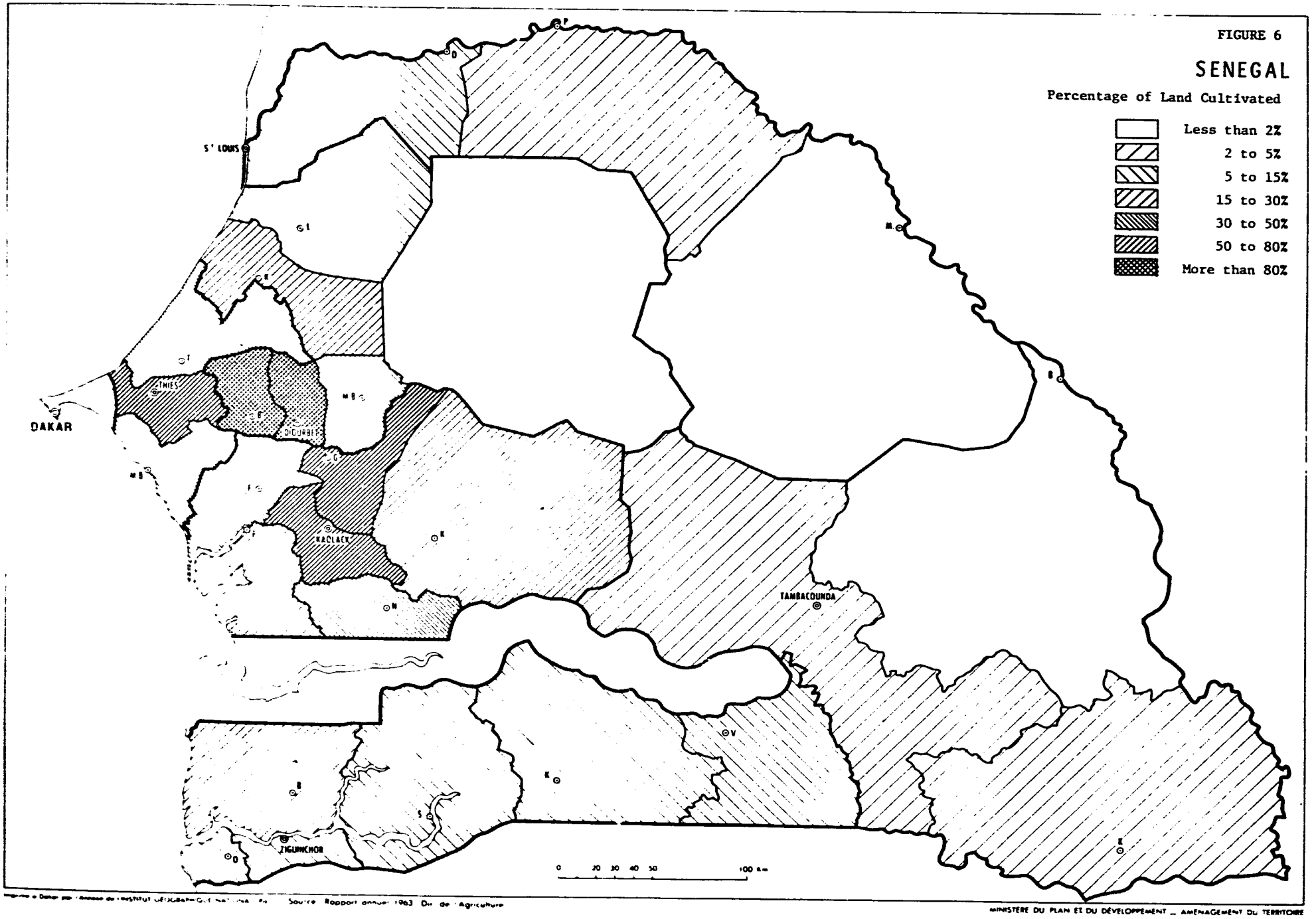
Storage facilities in the GOS buying program appear to be one of its limiting factors. Adequate grain storage facilities are limited as are trained, qualified personnel to implement a buying and storage program.

An announced goal of the GOS is to establish a reserve of millet and sorghum of 200,000 to 300,000 MT as a contingency for drought over the next 3 to 5 years.

Land holding patterns are mostly traditional. There is no private land ownership outside urban areas and the right to assign land for cultivation is vested in the village chiefs who are appointed by the GOS. With the exception of the overcrowded groundnut basin, rural production is not limited by land availability. Output is primarily limited by production techniques. While these have gradually improved, they remain predominantly traditional. Low productivity reflects the absence of formal education and practical training (the literacy rate outside urban areas probably is no more than 3 to 4 percent) and the limited amount of capital available for investments. Traditional techniques keep an active adult from cultivating more than about 4 to 5 acres (1½ to 2 hectares) of groundnuts or millet and somewhat less of rice. With the help of a draft animal, this figure might be doubled. Depending on the size of the family and on the use of animals, farms average 17 to 21 acres (7 to 8 hectares) and rarely exceed 35 acres (15 hectares). The percentage of land cultivated is shown in Figure 6.

Millet and Sorghum Production

Millet and sorghum are the basic food grain crops of Senegal. In 1973-74 production was 570,000 metric tons. The production for 1975 is estimated by ONCAD to be 610,000 to 640,000 MT. Millet and sorghum production figures are usually composite figures with millet normally representing three fourths of the composite figure. Additional data on production of millet-sorghum, paddy rice, corn, dry beans and groundnut is included in Appendix C.



Source Rapport annuel 1963 Dir de l'Agriculture

MINISTERE DU PLAN ET DU DÉVELOPPEMENT _ AMENAGEMENT DU TERRITOIRE

TABLE 3. Food Grain Production-Senegal 1973-74

Region and Department	Millet and Sorghum	Paddy Rice	Cowpeas	Maize	Fonio
		(metric tons)			
Sine-Saloum Region Total	160,400	200	1	900	40
Thies Region Total	103,300	400	4,100	-	-
Diourbel Region Total	161,700	-	8,600	-	-
Fleuve Region Total	27,400	9,800	1,900	14,200	-
Senegal Oriental Region Total	32,500	4,700	-	16,200	2,040
Casamance Region Total	84,300	49,100	500	13,900	400
Cap Vert Region Total	1,100	-	40	-	-
NATIONAL TOTAL	570,700	64,200	15,141	45,200	2,480

Source of Data: Rapport Annuel, Direction des Services Agricoles, Ministere du Development Rural, Senegal 1974.

Millet and sorghum production in Senegal has been increasing in recent years. Much of this increase can be attributed to normal or above normal growing conditions as well as the introduction of improved inputs which includes heavier fertilizers, better seed varieties and the increased use of animal traction.

As a part of the overall GOS policy with regard to cereals, concerted efforts have been underway for 4 years to stimulate production within the country. These special efforts have been carried out by SODEVA (Societe de Developpement et de Vulgarisation Agricole) first in Sine Saloum region with assistance from the CCCE (Caisse Centrale) from 1972 to 1975. A similar AID project was initiated with SODEVA in March 1975 in the Thies and Diourbel regions whereby a package of technical practices are introduced on farms through extension-like activities to intensify local production. Emphasis is given to such things as

animal traction, improved implements, fertilizers, and good seed which are factors known to increase yields of millet and sorghum grown in the area. The IBRD recently completed a study of the SODEVA/CCCE project in Sine Saloum and as a result extended a credit of $15 million to continue and expand that effort.

The areas served by these projects constitute the groundnut basin of Senegal which is also a highly important cereals production area. Increased cereal production from these two projects will most certainly add to the already acute nature of the cereals storage problem. The phases of these on-going projects addressing the storage problem (such as training in on-farm storage and extension of credit to build on-farm storage by the AID project) will help locally, but the broader aspects of cereal storage must be addressed by considerably larger inputs of expanded storage capacity and training.

In addition to the limited efforts to deal with storage problems of these essentially production-oriented projects, AID is encouraging the GOS to develop a plan to utilize in cereal storage work 117,000,000 CFA of counterpart funds generated 3 to 4 years ago by sales of PL 480 grains. Current thinking going into the development of this plan is to assist, through SODEVA, with the construction of on-farm and cooperative (village) level medium to small sizes of storage units.

Because of wide fluctuations in annual rainfall, crop outputs of millet and sorghum in Senegal tends to fluctuate widely. In 1965 estimated production of millet and sorghum was 554,000 metric tons, the following year production dropped to 423,000 metric tons. More recently a short crop brought on new awareness by the GOS of the country's disruptive production pattern.

TABLE 4. Millet and Sorghum Production 1964-1974 and 1975 Estimate in Metric Tons

Year	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70
Production	531,762	553,756	423,448	654,960	449,459	486,400

Year	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76 Est.
Production	400,800	582,700	322,000	510,000	570,700	610,000 - 640,000

10-Year average 1965-74
Production figure 548,598

Source: Rapport Annuel, Direction des Services Agricoles, Ministere du Developpement Rural, Senegal 1964/65-74

Consumption of Millet and Sorghum:

Consumption of millet and sorghum is higher per person than any other food grain. It is generally concluded that consumption is significantly higher in the rural areas because of lack of availability of imported rice and lower per capita incomes. A study of overall national consumption was carried out in 1973 showing a per capita consumption figure for millet and sorghum of 114.89 kg/year. This figure is generally considered to be low since the data was collected during a year of a below average crop.

TABLE 5. Food Grain Consumption 1973

Crop	Consumption kg/yr/person
Millet and sorghum	114.89
Rice	80.85
Wheat	22.7
Corn	14.35

Source: Project d'Implantation d'une Minoterie de mil - April 1974 Societe Nationale d'Etudes et de Promotion Industrielle

An earlier study made in 1969 by the Societe Nationale d'Etudes et de Promotion Industrielle indicates that a more normal consumption of millet and sorghum is 137 kg/year per person (See Appendix A and D).

The Marketing of Millet and Sorghum

Background

In general the Senegalese farmer considers his millet and sorghum crop a subsistence crop, however, during years of surplus production, these farmers enter the market economy.

Peanuts are generally considered by the farmers to be their cash crop, thus in response to favorable prices and guaranteed markets more land has traditionally been devoted to peanut production than to the primary food crops of millet and sorghum. Because the Senegalese farmer is now at least partially in the money economy, his needs for income to buy consumer goods have increased in more recent years. Cash to satisfy his family's needs for consumer items such as sugar, cloth, salt and grain has increased. Cash returns from peanuts are not evenly distributed throughout the year and the need for cash is just before peanut harvest. Historically it is in this period that he must buy grain at much inflated prices. Many times he will sell or contract part of his new crop before harvest at a reduced price below official prices.

In the past, much of the marketing of food grain has been through private traders. A typical pricing pattern was to have a price of 10 to 17 CFA/kg from harvest time to December. January to the summer months prices would increase to 25-35 CFA/kg (the period when the needs were the greatest). Prices in drought years, or just following drought years, could be double the prices of a normal year.

In the past, decreed prices have existed and were to be enforced by the Government's official marketing agency, ONCAD, by purchasing and storing millet and sorghum for resale. Because of a lack of suitable storage, competition with its peanut programs, and other factors, ONCAD has not purchased a very high percentage of the millet and sorghum crop.

The Current Situation

The GOS current agricultural policy is to obtain self-sufficiency in grain production through the commercialization of food grains. Because storage facilities for food grains have been a limiting factor, the GOS will shortly let contracts for the construction of 30,000 MT of storage. The storage structures are all to be of the 1,000 to 2,000 MT size. ONCAD is to use these storage facilities as buying stations and establish cooperatives similar to their present peanut marketing program.

ONCAD bought 30,000 MT of millet and sorghum in 1974 at a price of 30 CFA/kg. It is presently stored in central locations. The 1975 harvest is being temporarily stored in its peanut seed "seccos". Storing in the seccos is currently a problem because there is not enough space for the millet and the peanut seed, consequently when the peanut seed enters the "seccos" the millet must be moved outside and stored in the open thus exposing the millet to potential losses. So far losses from storing outside have been minimal because the peanut seed has been taken out of storage just prior to the wet season with the millet returned to the "secco" before the rains. If an early rain should occur, damage could be substantial.

ONCAD's 1975 millet/sorghum policy was announced in November 1975 and included a pricing policy to purchase 100,000 MT of sorghum and millet at 30 CFA/kg throughout the entire season. It is unclear where the additional 100,000 MT will be stored. It is also unclear exactly what part private trade will have in the new program but as it is presently stated it would be illegal for the private trade to buy directly from farmers.

The GOS has announced that it has a goal to establish a reserve of 200,000 to 300,000 MT of millet and sorghum for a drought reserve. The present reserve is about 45,000 MT.

Until November 1974, when the GOS eliminated the subsidy on imported rice, consumer prices were at an irrationally low level. Recognizing that subsidized consumer prices were taking away incentives for farmers to produce for the market economy, subsidies on vegetable oils, rice and sugar were eliminated.

New marketing policies now in effect include guaranteed farm level prices 30 to 40 percent above old levels. Millet is now at 30 CFA/kg, a level that is considered to be well above the variable costs of production and competitive with the 41 CFA/kg for peanuts.

Rice Consumption, Importation, and Production

The consumption of rice has been growing rapidly in Senegal. Production has not kept up with the rapidly expanding demand requiring very large annual imports. In 1974 this amounted to 157,782 MT. (See Table 6.)

TABLE 6. Rice Imports

Source	Calendar Year 1974
Brazil	15,645
China (PR)	27,174
Pakistan	10,963
Thailand	28,000
USSR	76,000
Total	157,782 MT

The importation of rice represents a large drain on Senegal's foreign exchange.

The demand for rice is growing because of its ease of preparation compared to millet and increased urbanization. However, the demand appears to diminish during years of a poor peanut harvest when incomes are low.

Estimates of National Consumption

Estimates of national consumption (including imports) are shown for the period 1969 through 1973 for wheat, maize, rice and millet and sorghum in Appendix D.

Pricing Policy of ONCAD

It is recommended that the pricing policy of ONCAD be announced well in advance of planting time. The price list that is announced should take into account such factors as the cost of production of millet and sorghum to the producers, world prices, profit margins, cost of marketing, transportation to market, and marketing costs as well as inflationary trends of the economy.

Payments to farmers should be on time and in cash. This must be done to increase the creditability of ONCAD.

Credit should be extended for the inputs of production similar to ONCAD groundnut program with payments made from millet sales receipts.

IV. EVALUATION OF STORAGE FACILITIES AND METHODS FOR SENEGAL

Proposed ONCAD Warehouses

ONCAD has proposed the construction of an additional 120,000 MT of storage capacity for various locations in Senegal to consist of 1,000 and 2,000 MT warehouses.

The ONCAD warehouses, see Appendix E and F (reference drawings numbered 75.06, February 13, 1975, and 75.07, February 13, 1975, on file in AID/W and ADO/Dakar), are designed for either bag storage, or bulk storage inside a perimeter bulkhead of bagged product. That is, the walls are not designed to withstand the lateral pressures from bulk grain.

1. Dimensions

a. The 2,000 metric ton units are 20m x 50m x 4m sidewall height; 1,000 ton units are 20m x 25m x 4m sidewall height.

Using the stacking pattern proposed by ONCAD (a 1m wide aisle all around the perimeter of the building, a 2m wide center-aisle lengthwise in both the 1,000 and 2,000 ton units, a 2m wide cross-aisle in the 1,000 ton units and stack heights of 3.5m), the capacity is approximately 784 tons and 1,640 tons for the 1,000 ton and the 2,000 ton units, respectively (assuming 1.5 cubic meters per metric ton).

The height of the proposed warehouses (4m sidewall) is scarcely adequate for stacking 3.5m high. A sidewall height 2m greater than the stack height would allow a man to walk on top of the stacks, thus facilitating stacking and fumigation operations (stacks must be covered with a gas-tight cover during the fumigation operation).

By increasing the warehouse height and forming stacks 4 to 6 meters high, economy could be gained by greater utilization of floor space; suggested sidewall heights for these stacks would be 6 and 8 meters, respectively.

2. Materials

Sidewall construction is of concrete blocks (15 cm thick) with outside sealer (stucco) and has the following advantages:

a. Will withstand bumping by equipment better than corrugated steel siding;

b. Can utilize Senegalese materials such as sand, gravel and cement;

c. Utilizes common construction practices, the Senegalese apparently have not had much experience with erecting prefabricated metal buildings;

d. Lower heat conduction than a galvanized steel sidewall.

Some disadvantages of concrete block wall construction are as follows:

a. Lack of quality control on blocks, mortar joints and the plastered sealer coat (stucco);

b. Rough, hard-to-clean inside surface;

c. Most block walls observed in the field had cracks.

Foundation is 20 cm wide x 50 cm height (minimum) reinforced with six horizontal bars 10 mm in diameter and two vertical bars 6 mm in diameter (at 20 cm intervals). The foundation sets on a spread footing 5 cm thick poured in the bottom of the excavated trench (perhaps 70 cm wide). The concrete mix for the foundation is 350 kg of cement, 450 liters of sand and 900 liters of gravel per cubic meter.

The concrete foundation should extend sufficiently deep to reach firm subsoil and to prevent rodents from underburrowing. The strength and soil-bearing capacity of the foundation must be adequate to carry the roof load and the outward thrust from the trusses. Provisions appear adequate to prevent erosion from the roof runoff even without eave gutters.

Floors are of 10 cm thick concrete (over 15 cm of packed sand fill) reinforced with welded wire fabric 15 cm x 15 cm x 5 mm in diameter weighing 2 kgs/sq. meter. The concrete mix is 300 kg of cement, 450 liters of sand and 900 liters of gravel per cubic meter.

These floors appear adequate if vehicles are not driven into the warehouses. A vapor-proof plastic film under the concrete floor will help to permit the concrete to cure properly and to maintain a dry floor.

Sliding steel doors should be tight fitting and of a type not easily damaged by bumping, to keep the building rodent-tight.

Asbestos-cement roofing has the following advantages:

a. Long life;

b. Local labor has experience with this product;

c. Heat conduction is lower than that of galvanized steel;

d. The long overhang of the roof appears adequate to prevent rain from blowing through the ventilation openings in the upper sidewalls.

e. Produced in Senegal.

NOTE: A white or aluminum roof surface is desirable to reduce the heat buildup inside the building. The steel trusses and columns spaced 5m apart eliminate any necessity for any interior supports which would interfere with fumigation. All steel components, such as steel roof purlins, concrete reinforcing steel, trusses and fasteners would be imported.

3. Ventilation

The openings along the upper sidewalls and at the ridge of the roof appear adequate to keep the inside temperature within tolerable levels for both man and grain. Screens must be maintained to keep out birds.

4. Site Preparation

The site should be graded for proper runoff of rainfall away from the building and to assure that the floor is well above the highest expected flood level. Avoid building in a flood plain.

5. Fencing

The warehouse area should be fenced and guarded against unauthorized entry. The fence should be at least 20 meters beyond the storage building and the intermediate area kept closely mowed to discourage rats from the area.

6. Office

The present plans show no office area. Space must be provided for records, supplies, equipment (such as moisture testers and grading apparatus) and a working area. The working area should be well lighted and, possibly, air-conditioned.

7. Estimated Construction Costs

The ONCAD engineer in charge of the warehouse maintenance and construction, Mr. Amadou Khouma, supplied the following cost estimates:

a. Cost of site preparation
   300 CFA/sq meter for sandy soil
   400 CFA/sq meter for clay soil
   600 CFA/sq meter for gravelly soil

b. Foundation excavation @ 600 CFA/cu meter

c. Foundation concrete @ 30,000 CFA/cu meter

d. Concrete floor @ 15,000 CFA/cu meter.

NOTE: Exchange rate in November 1975 was approximately 220 CFA/$1.

Dr. Gordon Yaciuk, agricultural engineer at the National Agricultural Research Center near Bambey, supplied the following local prices for construction materials:

a. Cement @ $3.10/80 pound bag

b. Galvanized steel roofing @ $4.50/sheet, 80 cm x 2 m

c. Polyethylene film @ $1-$2/sq meter

d. Lumber, approximately 2" x 4" x 4 m @ $1.50 (termite-proofed)

e. Rebar, 12 mm x 6 m @ $9.00
Rebar, 6 mm x 6 m @ $1.50.

Dr. Yaciuk makes concrete blocks from 350 kg cement, 500 liters of sand and 750 liters of gravel per cubic meter of mix.

Location of Grain Storage Warehouses

For long-term storage of cereal grains (1 year or longer) the warehouses should be located in regions of lowest humidity, preferably inland 75 kilometers (about 50 miles) or more and in regions with annual rainfall less than 600 mm per year or north of latitude 14° North.

ONCAD indicated that a contract for 30,000 MT of 1,000 and 2,000 MT capacity warehouses has been completed and should be under construction in the near future. Storage under contract and additional storage required is shown in Table 7.

TABLE 7. Warehouse Construction-Proposed Initial Phase

Region	Capacity Proposed Construction By ONCAD	Capacity Proposed Construction By USAID *
Fleuve	5,000	5,000
Thies	-	10,000
Diourbel	10,000	6,000
Sine-Saloum	15,000	6,000
Casamance	-	3,000
Senegal Oriental	-	-
	30,000 MT	30,000 MT

*The rationale for these locations will have to be verified by further study.

Appendix G shows a list of warehouses by order of priority of completion, prepared by ONCAD. Capacity for specific locations in the various regions are also shown.

Warehouse Construction Costs

ONCAD Design. Cost of the 1975-76 warehouse construction quoted by ONCAD is approximately $100 per metric ton of rated storage capacity or an approximate cost of $18.60 per square foot of floor space.

Assuming a usable capacity of 784 MT and 1,640 MT for the warehouses rated at 1,000 and 2,000 MT, the unit costs for the storages are $127.55 and $121.95 per metric ton, respectively.

The U.S. Embassy Office Building construction contractor, SATOM, estimated the cost of the 1,000 ton ONCAD warehouse at 20,000,000 CFA ($91,000) and the 2,000 ton warehouse at 36,000,000 CFA ($164,000) as of November 1975. SATOM's estimate is to the 3 foot line around the building and does not include utilities. Inflation could increase the costs by 1½ to 3 percent per month.

Prefabricated Steel (See Appendix H). Estimated erected cost for a white-painted, prefabricated steel building (60 feet by 180 feet) from the U.S. of size comparable to the 2,000 ton ONCAD unit, except with 20 foot sidewall height (ONCAD's warehouse has 13.1 foot sidewall), is approximately $143,000, if duty free.

Adding 15 percent for site preparation and contingencies boosts the estimated cost for a prefabricated steel building to approximately $165,000, which is essentially equal to SATOM's estimate for the ONCAD warehouse.

Similarly, the estimated cost for a 60 feet by 90 feet prefabricated steel building (1,000 tons capacity) is approximately $95,700 (compared to

$91,000 for the ONCAD warehouse as estimated by SATOM). The prefabricated steel buildings have an advantage in being approximately 2 meters higher than the ONCAD warehouses which allows stacking to at least 4 meters with clearance to walk on top of the stacks.

The prefabricated steel building price includes a continuous ridge ventilator but no under-eave inlets. The ONCAD units have both under-eave and ridge ventilation which cannot be closed. In humid areas during the rainy season, moisture absorption by the stored grain may be reduced by closing all openings at night and other intervals when the relative humidity exceeds 70 percent.

Table 8 presents a summary of estimated construction costs comparing concrete and pre-fabricated steel warehouses.

Comparison of ONCAD Warehouses with Prefabricated Steel Buildings

The ONCAD warehouse design has walls and roof with greater insulation values and less heat reflectivity so that the heat gain should not differ substantially for the ONCAD warehouse compared to a white-painted, prefabricated steel building.

The inner surface of the walls on the ONCAD warehouses will be more difficult to clean than the walls of a steel warehouse, however the corrugations in the steel walls will tend to trap grain at the floor level and make clean-out of grain from the floor around the walls more difficult in a steel warehouse. Advantages between the two designs are varied but about equal. A disadvantage of the ONCAD warehouses would be the likelihood of cracks developing and creating sanitation problems. The walls of the ONCAD warehouses would be more resistant to bumping by equipment than would corrugated steel siding.

TABLE 8. Summary of Estimated Warehouse Construction Costs

	1,000 M. Ton ONCAD WAREHOUSE	1,000 M. Ton PREFAB STEEL WAREHOUSE	2,000 M. Ton ONCAD WAREHOUSE	2,000 M. Ton PREFAB STEEL WAREHOUSE
Dimensions (Outside)	20m x 25m	18.3m x 27.4m	20m x 50m	18.3m x 54.9m
Area (gross)	500 m^2	502 m^2	1,000 m^2	1,003 m^2
Sidewall Height	4 m	6.1 m	4 m	6.1 m
Estimated Cost	$91,000	$95,700	$164,000	$164,600
Estimated Cost per Square Foot	$16.91	$17.72	$15.24	$15.24
Estimated Net Capacity M. Ton (3.5m stacks vs. 4m stacks)	784	858	1640	1792
Estimated Cost/M. Ton Capacity	$116.07	$111.54	$100.00	$91.85

The ONCAD warehouses have excellent provision for ventilation under the eaves and at the ridge whereas the steel prefabricated building has only ridge ventilation but has the advantage that the ventilation opening can be closed during the night in regions of high humidity. NOTE: Louvered openings, either fixed or closeable, could be located in the walls of the prefabricated steel buildings for increased ventilation but at considerable cost.

The construction of the ONCAD-designed warehouses has the following advantages, compared to a prefabricated steel building from the United States:

a. More utilization of local labor;

b. Less training required for unfamiliar building techniques;

c. Fewer logistical problems in shipment of components, lost packages, etc.;

d. No building specialists from the United States required to oversee construction;

e. No problems with British-sized components in a metric society;

f. Less need for power tools (such as nut-runners for putting screws in metal buildings).

Annual Warehouse Costs

The following fixed cost for a 2,000 ton warehouse is based on a building cost of $200,000.

Building Depreciation, 20 years	$10,000
Interest @ 6% on ½ of building cost	6,000
Insurance @ 1% of building cost	2,000
Maintenance @ 1% of building cost	2,000
Total Annual Cost	$20,000
Annual Building Cost per Ton Based on 2,000 ton Capacity	$10 per Metric Ton

AID EXPERIENCE WITH WAREHOUSE PROJECTS

AID has had experiences in the warehouse construction field in Mauritania, Niger and Upper Volta. The implementation of projects in Mauritania was carried out under the Sahel emergency R & R program in 1973/1974. Thirteen warehouses with a capacity of 1,000 to 2,000 metric tons each were constructed throughout the country. The program had the collaboration, cooperation and financial assistance of FED.

AID also had a Cereals Sector Loan with the Entente Fund in 1972 which financed the first 2 years of warehouse requirements and office facilities for the National Cereals Offices of Niger and Upper Volta. This loan totaled $1,800,000 and called for the construction of 16 warehouses in Niger with capacities between 500 MT and 1,500 MT as well as 11 warehouses in Upper Volta with the same range of metric ton capacity. Two of the warehouses built in Upper Volta and Niger were prefabs and we understand that they are giving excellent results. The prefabs were built in Upper Volta as demonstration units and have proven themselves to be completely acceptable to the Government officials and officers of the Cereals Office in that country.

Bag Versus Bulk Storage

Even though bag storage of grain seems to be emphasized by the GOS and in this report, the possible use of bulk storage should not be ignored.

There are advantages and disadvantages to each type of storage and one or the other may be more applicable to a given situation at a given time. Senegal in 1975 is considered in listing the following advantages and disadvantages of bag storage:

1. Advantages of bag storages:

   a. Most of the methods of transport in rural areas currently require that grain be bagged;

   b. Equipment for bulk handling is not readily available;

   c. Spare parts, power sources and trained personnel for operation and maintenance of mechanical equipment for bulk handling that are not readily available;

   d. Storages can be used for storing other products as grain is sold out, or when bulk handling becomes an accepted practice and other types of storages are built;

   e. One storage unit can accommodate several kinds and grades of grain;

   f. May facilitate operation of a warehouse on a "first in," "first out" principle.

2. Disadvantages of bag storages:

   a. Bagged product is difficult to sample;

   b. Aisles around stacks of bags decrease utilization of space;

   c. High cost and short supply of bags;

   d. High labor requirements;

   e. More susceptible to rodent and insect damage.

At this stage in the technology and mechanization of grain handling in Senegal, the advantages of bag storages of grain may well outweigh the

disadvantages. By initially building the warehouses sufficiently strong to withstand the lateral pressure from bulk grain, later conversion to bulk storage in these units would be facilitated. However, the original cost would be much greater, and unjustified unless the conversion occurred. The cost of a typical pre-fabricated steel building designed for bulk grain storage is approximately double the cost of the same size unit not designed for bulk storage.

Erected costs of typical U. S. corrugated steel, farm-quality, grain bins 27 feet in diameter with 16 feet sidewalls (22 feet 10 inches overall height, rated at 8,350 bushels level full) is approximately $75 per metric ton if filled to about the 15 feet level to leave 1 foot eave clearance for covering the grain for fumigation. This cost does not include equipment for filling or emptying the bin, which should be offset by the savings from reduced labor from bulk handling. If material must be received and shipped in bags, the advantage of a bulk storage system is questionable. Certainly, less sacks may be required.

The extra flexibility and the minimization of technology required for the proposed ONCAD flat-storage warehouses may well be worth the extra cost.

Conditioning of Grain

Millet is harvested at approximately 25 percent moisture content, is at 10 to 15 percent moisture content by early November (drying in ricks on the ground) and will be at 5 to 6 percent moisture content by January.

If grain is bought at 10 percent or lower moisture content and kept under cover, no drying or aeration equipment should be required for storage in the less humid regions of Senegal (see section on location of ware-

houses). If drying is required, spreading grain in thin layers and exposing to the sun should be adequate for drying except during the rainy season.

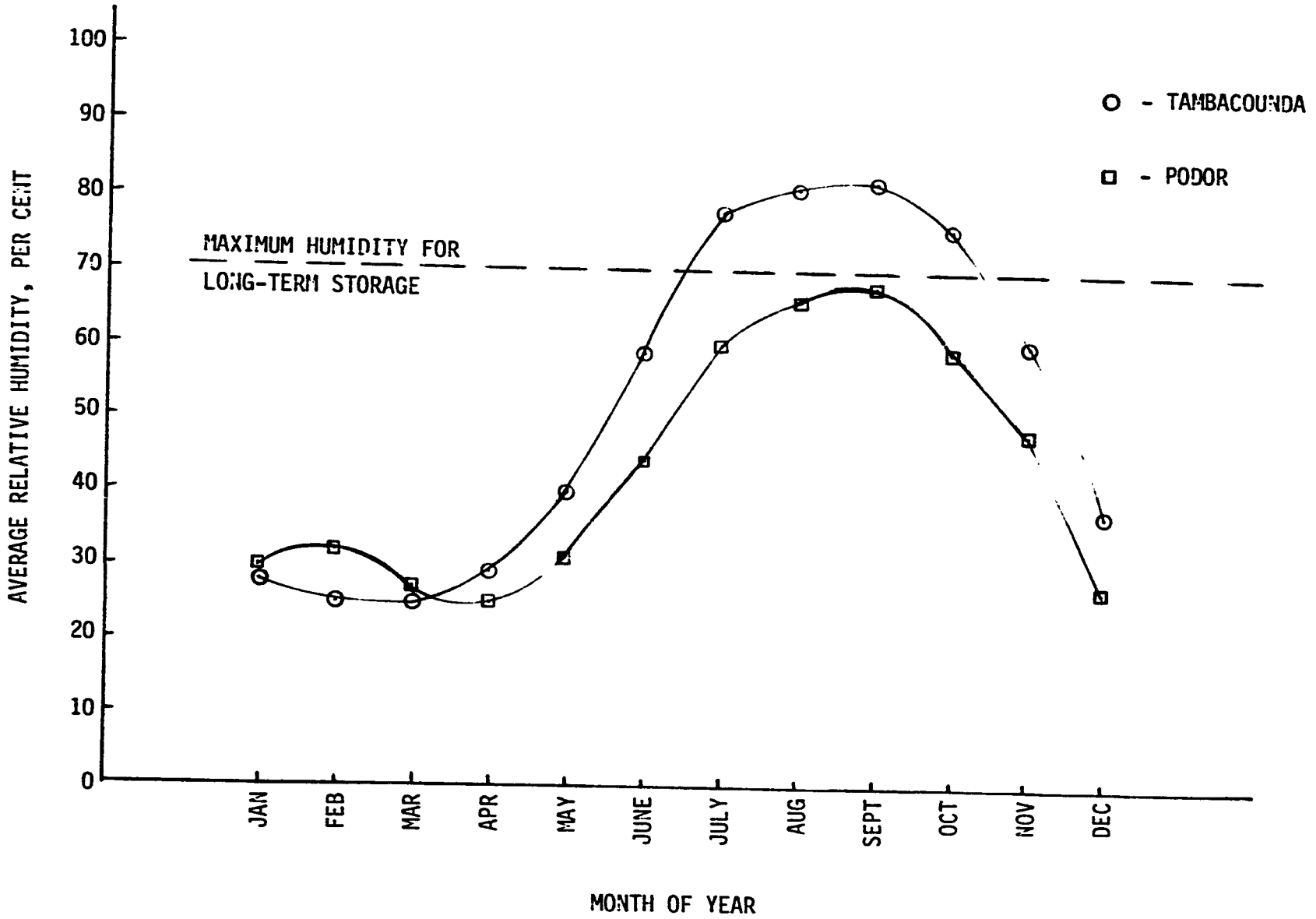
Recommendations for operation of the proposed grain storages would stress operations of the warehouses on a "first-in, first-out" basis to minimize moisture buildup in the stored grain. As can be seen from the weather data in Appendix I, the relative humidity at most of the weather stations in Senegal during the 4 months July through October exceeds 70 percent and would be conducive to moisture buildup and mold growth. Grain conditions and moisture content should be determined weekly and corrective action taken if grain is going out of condition. For example, if grain is above the moisture content in equilibrium with 70 percent relative humidity air, drying, blending with drier grain or immediate consumption will be required.

From the graph (Graph 1) of average relative humidity by month for two locations in Senegal, one can see that the region around Podor is favorable to long-term storage (average humidity below 70 percent for all months) whereas the region around Tambacounda has average humidities over 70 percent at least 4 months of the year. Therefore, long-term reserves should be kept in storages located in the drier areas of Senegal (the northeastern areas, in general) and stocks near the coast and in the Casamance should be utilized within 1 year after storage, if possible.

From the wind data at St. Louis, maximum velocity 114 miles/hour, one can see the advisibility of locating inland from the standpoint of wind as well as from the humidity factor. The ONCAD buildings are designed for 100 to 120 km/hour winds (62 to 75 mph) considering the average maximum wind

GRAPH 1

AVERAGE RELATIVE HUMIDITY BY MONTH FOR A HUMID LOCATION AND FOR A DRY LOCATION IN SENEGAL



velocity in Senegal to range from 70 to 90 km/hour (43 to 56 mph). If pre-fabricated steel buildings are utilized, the allowable wind load should be at least 25 pounds per square foot.

Research should be considered to investigate the response of bagged grain covered with various formulations of plastic film (various polyethylenes and polyvinylchlorides) to high humidity - high temperature environment compared to the response of uncovered stacks of bagged grain.

Consideration should be given to utilizing two low-cost moisture testers in each location and compare readings daily as a quick check for accuracy. Oven drying tests should be conducted at frequent intervals to check the accuracy and calibration of all meters. Oven tests should be conducted to check any meter whose accuracy is in doubt.

Grading System

A grading system should be devised to pay for grain on a dry matter basis, thus discounting grain with excessive moisture and paying a premium for drier grain. This will give farmers an incentive to dry the grain before delivery and will minimize storage problems from mold and insects and reduce the bulk to be stored and transported.

The grading system should include discounts for foreign matter such as stones, pieces of stem, chaff, weed seeds, moldy grain, rotten grain, insects and other grains.

Equipment Needs

Each buying station should have a battery-powered moisture tester for quick determination of grain moisture content before the grain is purchased. A grain trier and a set of sieves for each type of grain purchased (corn,

millet, sorghum, etc.) will facilitate sampling bags of grain and determining the amount of foreign matter and grade of the grain.

Each warehouse should have a battery-powered moisture tester, a trier, a probe-type thermometer and, possibly, a hygrometer. The moisture testers for the warehouses should be more accurate than those used at the buying stations.

The estimated cost of equipment is itemized in Appendix J.

V. GRAIN PRESERVATION AND QUALITY MAINTENANCE

The importance of preservation and maintenance of cereal grain (millet, sorghum, maize, rice, wheat) quality has not been fully realized in Senegal. Efforts are being made to increase production so that imports of cereals can be reduced and reserve stocks accumulated for periods of drought and poor production. As greater quantities of cereals are produced and reserves accumulated, the need for adequate storage facilities and knowledge of improved methods of preservation increases.

The following parts of this section review the:

- Present status of grain preservation and quality maintenance;
- Status of personnel trained in grain storage;
- Past, present and proposed grain storage training program;
- Need for additional training;
- Benefits to be derived from training.

A plan for training Senegalese in grain preservation and quality maintenance has been developed and is included in this report.

Present Status of Grain Preservation and Quality Maintenance

Cereal grains are stored at several points in the marketing system in Senegal. At each level of storage, and in the movement from one level to another, there are opportunities for losses in quantity and quality of the cereal grains. Each of the various levels of storage present special problems in grain preservation and quality maintenance and are discussed separately in the following paragraphs.

Farm/Village Storage - According to a recent study, approximately 85 to 89 percent of the millet remains on the farm in the Diourbel and Sine-Saloum regions.[1/] Millet stored on-farm serves as food for the family and as "savings" from which other necessities may be purchased. Although no actual surveys have been conducted at farm level, the general consensus is that losses are quite low (1 to 5 percent).

In harvesting, stalks are cut down and heads of millet cut from the stalks and piled in ricks on the ground. Field drying in this fashion for about one month reduces moisture from 20-25 percent to 15-16 percent. Field-stored millet is subject to attack by termites and birds.

After field drying, heads of millet are bundled and carried to the village for storage or are stacked in rectangular piles approximately 1 meter wide, 1.5 to 2.0 meters high and length depending on quantity. Millet heads, partial heads or threshed millet are later placed in traditional bins of woven wood sticks said to possess "insecticidal properties." Head storage capacity of traditional bins is approximately 2 MT each.

According to several sources (SODEVA, CNRA and IDRC), traditional storage methods are quite effective in preserving millet on farms. Losses in the range of 1 to 5 percent may be experienced due to insects, primarily termites. Because of the potential for cooking-fire sparks igniting storage units, they are usually placed outside the living compound. While reducing the fire potential, this practice makes the stored grain more susceptible to theft and cross infestation by insects from the field.

1/ Rolston, W. D. (1975) The 1975 Followup Mission to West and East Africa-The Post-Harvest System and Its Problems as Perceived by the Small Farmers and Traders. Paper presented at the IDRC Post-Harvest Technology Workshop. Dakar, Senegal, 10 Nov. 75.

Very dry climatic conditions during the initial storage period results in continued drying of the millet in storage with little subsequent loss.

Pesticides are not commonly used at the farm level. However, increased farm storage of sorghum and maize has resulted in ITA and SODEVA efforts to develop improved techniques which may include insecticides. Losses of sorghum and maize are higher (10 percent estimated by SODEVA) than millet in farm storage.

SODEVA indicated that 40 kg capacity polyethylene bags filled with shelled maize and treated with carbon tetrachloride (CCl_4) are quite popular in the Sine-Saloum region where a maize intensification program is being conducted. Cost for the bag and treatment is 120 CFA/40 kg bag (3 CFA/kg).

ITA has developed an air-tight, steel drum for storage of cereal grains. However, the initial cost is high (6,000 CFA/drum), the capacity low (180 kg/drum) and drums are preferred for water over cereal grains storage.

CNRA and SODEVA are working with a crib design for ear maize storage, however, effectiveness of the crib has not been determined. Cylindrical (3 to 12 MT capacity) and rectangular (partitioned 16 MT capacity) bulk storage units are being tested by CNRA. Cylindrical storage units (Carera) are too costly at capacities required by the farmer. The rectangular unit is in the initial stages of development.

It is constructed of locally made blocks and has a galvanized steel roof. Dimensions are 3.4 meters wide, 8.8 meters long, 2.8 meters high at the front and 2.2 meters high at the back. There are eight interior cells 1.5 meters

deep and ranging in size from 1.9 to 6.3m^3 (1.6 to 5.1 MT capacity) providing space for a variety of cereal commodities. Total cost is approximately 160,000 CFA. An additional advantage is realized in that farmers may cooperatively obtain credit and share this type of storage facility.

Dealer Storage - Dealer and/or commercial storages vary widely in their condition and practices.

Local dealers' storage was not observed by the team. ONCAD is to have a monopoly on cereal grain purchases and will sell to dealers. It is doubtful that dealers would maintain storage facilities under this system because of the reduced potential for profit. It is, however, highly probable that a clandestine dealer trade will exist at the local level.

SOCOPAO, a commercial storage company, appears to maintain a good storage operation. It functions as a general warehouse, storing various items and commodities (including rice, wheat, fortified cereal blends, etc.).

Storage conditions at the SOCOPAO warehouse visited in Dakar appeared good. Bagged grains were neatly stacked on tarpaulins spread on a concrete floor about 1 meter above grade. SOCOPAO has three warehouses with approximately 6000 MT capacity each. An open asphalt storage area will accommodate approximately 20,000 MT of cereal grain in the Dakar SOCOPAO operation.

Although the team did not visit other SOCOPAO warehouses, they do exist throughout Senegal and it is presumed warehouses elsewhere in Senegal are operated in the same manner.

ONCAD Storage - Present ONCAD storage facilities are primarily devoted to groundnut storage. There are said to be some 500 to 620 "seccos"[1/] used for storage of groundnut seed. See Appendix K . In Sine-Saloum there are 137 seccos with 54,226 MT total storage capacity. When seeds are planted in June-July the seccos are available for storage of other cereals until the following groundnut harvest (roughly October to November). At this time cereal grains are moved outside for storage in favor of groundnut seed.

This type of storage practice (maneuvering of stocks) does not lend itself to the maintenance of cereal reserve storage.

ONCAD stores commodities at several levels in the marketing system. Groundnuts are purchased at "Coops" and stored in large piles directly on the ground. A Coop probably exists for every five villages. From the Coops, groundnut is moved to "seccos" where best quality groundnuts are placed in covered warehouse storage for seed purposes. Market groundnuts are left in piles in bulk on the ground or on concrete pads. Bagged groundnut or woven fence may be used to bulkhead piles of groundnut.

Pesticides are commonly dusted over storage pads (or ground under the pile) and around the periphery of the piles of market groundnut. This treatment is primarily for termite and millipede control. Pesticides previously used were BHC (lindane) or DDT dust, however, these materials are no longer approved. Malathion is approved and may be used for this purpose and may also be dusted over the surface of the groundnut pile. Pesticide dusts are also used in treating seccos prior to storage of seed groundnut and in treating layers of seed groundnut stored in seccos in bulk. ONCAD indicates Baygon is now used for this purpose.

1/ Secco refers to buying stations operated by ONCAD where a warehouse or warehouses of various types may be located. Warehouses at seccos visited were of galvanized or mud brick construction. Those of mud brick construction were generally in poor repair. Galvanized warehouses appeared to be well maintained.

Personnel at CNRA have obtained good results using Bromophos dust on groundnut seed-stock, on an experimental basis. Bromophos is not, however, approved for general use.

Millet purchased by ONCAD must be threshed and delivered to seccos in sacks by the farmer. A farmer indicated he receives an empty sack in return if the one delivered is serviceable. If not, millet is resacked and the unserviceable sack returned to the farmer.

Although transportation does not appear to be a major constraint, seccos are less convenient than Coops for farmer delivery of millet for sale.

In the past, millet has probably been stored in groundnut seed warehouses during the wet season (June-September) and may be moved outside, depending on need for groundnut seed storage, in November. This year millet and sorghum from seccos has been moved to central storage areas in cities such as Koalack, Thies, Diourbel, St. Louis and Ziguinchor. Only small quantities of current (1975/76) millet production have been received at seccos through November 20. The present rate of procurement of locally produced cereals is 6,000 MT/week and controlled by release of funds to ONCAD. The secco at Birkalane (Sine-Saloum) had about 7 MT and the one in the Thies region about 3.5 MT.

Conditions of storage at the two seccos varied considerably. At Birkalane the masonry warehouse where new crop millet was stored was poorly maintained. Wooden doors at the side were rodent chewed and there was extensive evidence of rodent (small rat) activity inside the warehouse in millet spillage, fertilizer and unserviceable bags. Although live insects were not noted on the bags of millet, infestation in the spillage will soon result in cross infestation. The galvanized metal warehouse to be used for groundnut seed was not observed on the interior.

At the secco in Thies region, bags of recently purchased millet were stored in a small room in the "office" structure. A Trogoderma larva was observed on one bag, obviously a result of cross infestation from the environment. The galvanized metal warehouse across the yard from the "office" was quite clean and had been dusted with Baygon in anticipation of the approaching groundnut harvest. A nearby warehouse of the same construction, as observed at Birkalane but in greater disrepair, was not to be used for millet or groundnut. Repairs to doors, roof and vents could possibly make this structure serviceable.

At present ONCAD is said to have approximately 45,000 MT of millet in reserve storage from the 1973/74 and 1974/75 crops in the following locations:

Region	City	Quantity
Thies	Thies	2,800 MT
Sine-Saloum	Kaolack	19,000 MT
Fleuve	Saint Louis)	
Diourbel	Diourbel)	23,200 MT
Casamance	Ziguinchor)	

Condition of the millet and central storage facilities at Kaolack and Thies was observed by the team. At Kaolack, millet is stored in two warehouses each of 10,000 MT capacity and also outside under tarpaulins adjacent to and between the warehouses and in an area near the warehouses. A total of 19,000 MT are stored at Koalack - 8,000 MT in one warehouse, 6,000 MT in the other and 5,000 MT are stored under tarpaulin. Several "stack" record cards were observed which indicated that the millet when received was infested with Trogoderma and that it was fumigated the same date received. Receipt dates as early at May 5, 1975 were noticed and as late as mid-October 1975. Even though the millet had been fumigated as recently as October 10, 1975, there was evidence of live insect infestation on the bags.

Older stacks of millet showed obvious evidence of Trogoderma infestation. Infestation noted on more recently received millet was primarily Tribolium sp., however, there was evidence of light Trogoderma infestation and some Ephestia sp. moth infestation.

All products stored in these warehouses were on pallets, however, there was extensive spillage of millet under all pallets, between rows of stacks of bags and along walls. Dust, moth webbing and other evidence of insect activity were noted on walls. Piles of used bags and millet were also noted at various points in the warehouses. Evidence of rodent activity was also noted in the warehouses.

Grain stored outside the warehouse was under tarpaulin and not readily accessible for inspection. A drainage ditch system and accumulation of material in the system makes this an ideal situation for rodents. Millet stored outside was stacked over the drainage ditch in some areas.

At Thies, millet and sorghum stored in a small warehouse at the Regional Office compound has been heavily infested with Sitophilus sp., and to a lesser extent with Rhizopertha dominica and Trogoderma sp. Bags were stacked on woven reed mats. There was extensive spillage in all areas of the storage facility.

Millet stored at another complex of small warehouses (about 7, each with dimensions 12 x 30 meters) was on pallets but with extensive spillage throughout the warehouse. Millet observed here had been heavily infested with Trogoderma sp.

Approximately 2,800 MT of millet was being stored in a hangar at a former military air base. The hangar would hold a maximum of 8,000 MT (60 x 80 x 8 meters). Spillage here was being swept and resacked, however,

some spillage existed in the storage area. Millet being stored here had not been fumigated as yet and there were live Trogoderma larvae on the exterior of bags in several locations. Pits in the walls of the masonry hangar had accumulations of dust, groundnut residues and evidence of Trogoderma infestation.

The purpose of the rather lengthy description of storage conditions observed, points up the following deficiencies in storage methods now employed by ONCAD:

1. Preparation of storage facilities for millet and sorghum storage does not appear to get the same degree of care as for groundnuts;

2. Pesticides are used in preparation for groundnut storage and although the team was told that millet warehouses are cleaned and treated with insecticide prior to storage, evidence was to the contrary;

3. Conditions favoring cross infestation of commodities exist in all facilities where millet and sorghum were observed in storage;

4. Present methods of grain storage and preservation are not effective in preventing losses to the reserve stock of millet.

Inspection procedures as outlined by ONCAD employees include inspection of all stocks in storage every 15 days with records of the inspection sent to ONCAD/Dakar.

What percentage of bags from each stack are sampled, how much sample is taken, ultimate disposition of the sample and decisions or action to be taken on basis of sample analysis have not been fully determined.

Stack records of millet observed at Koalack indicated an initial inspection at time of receipt but no subsequent inspections. Stack records were not observed in use at other ONCAD storage sites.

Location and capacities of ONCAD Grain Storage Centers are shown in Appendix L.

At the present time, ONCAD indicates it has approximately 242,000 MT capacity in central storage facilities. Existing storage capacities by location are shown in Appendix L. This does not appear to include two warehouses observed at the Dakar port which have an estimated 8,000 to 10,000 MT capacity each.

As indicated previously, ONCAD has a program to construct several warehouses of 1,000 and 2,000 MT capacity at various locations throughout Senegal. Tentative locations are shown in Appendix G. Plans for the two sizes of warehouse are shown in Appendix E and Appendix F.

Processor Storage - As indicated previously, 85 to 89 percent of the millet is probably stored on farms at present. Cereals consumed on the farm are hand pounded by women using wooden mortar and pestle implements. Storage at this level has already been discussed.

Custom processors probably do not store quantities of cereal grains but process those brought to the mill by customers.

Two large commercial mills exist in Dakar, Les Grands Moulins de Dakar and the SENTENAC mill.

The Grand Moulin has a processing capacity of 500 MT/24 hrs. and produces approximately 70,000 MT of flour per year. Wheat is the only cereal processed and is supplied primarily from France.

Wheat received in 8,000 - 10,000 MT lots by ship is unloaded pneumatically using four 50 MT/hr units (200 MT/hr total). Bulk wheat from the ship is conveyed into a large concrete flat storage area leased by the Grand Moulin. A total capacity of 30,000 MT is available (this probably includes some outside storage), at dockside.

Bulkheads of 200 liter drums filled with wheat and draped with jute bags have been constructed to bear the lateral pressure of bulk grain. Cracks in the concrete walls indicate previous load problems. The mill indicates they do not have insect problems because the wheat is disinfested in France before shipment and the wheat is only stored for about 1 month. The drum-bulkhead constitutes a major insect problem even though the mill claims no loss. The drums of wheat and jute bags were heavily infested with several species of insects (including Trogoderma sp., Sitotroga cerealella, Cryptolestes sp. and others) and would constitute a source of cross infestation to any grains stored in the facility. A similar bulkhead system exists under a covered area adjacent to the concrete structure.

Wheat is loaded from the bulk storage area into trucks using portable augers and transported to the mill where 2,000 MT storage capacity in the form of twelve round, concrete silos exist.

The SENTENAC mill processes wheat and maize and is equipped to process millet. Approximately 15,000 MT of wheat and 5,000-15,000 MT of maize are processed each year.

Grain is received in bulk by ship and unloaded by "clam-shell" lifts into trucks and delivered to the mill. There is 3,000 MT of silo storage at the mill. If insect problems occur, grain at the mill is fumigated with Phostoxin either in bulk or under 200 micron polyethylene tarps (SENTENAC makes polyethylene). If grain is fumigated at the dock, SEAC fumigates at 400 CFA/MT. Cost for fumigation at the mill (by mill employees) is 150 CFA/MT.

Port Facilities Storage - Storage at the Port of Dakar includes the bulk storage leased by the Grand Moulin, two 14,000 MT capacity warehouses operated by ONCAD, and warehouses operated by groundnut processors.

Considerable storage of commodities appears to exist under tarpaulin in the Port area.

No estimates of loss to grain at the Port are available.

Food For Peace Storage - A facility used for the storage of Food for Peace relief grains were visited by the team. Construction and maintenance of the facility contracted for storage was poor from the standpoint of grain quality preservation. Storage methods were also inappropriate. For example, grain sorghum destined for Mauritania, in this case, was in sacks and had been stored directly on a partially earthen floor. Recent rains and flooding of the warehouse had resulted in total destruction of a considerable amount of the grain sorghum by molds. Evidence of rodents was

present and open windows and poor fitting doors would not have excluded rodents and/or birds. The remaining grain sorghum had been restacked on pallets and fumigated. Recommendation for proper storage of Food For Peace commodities is included in Appendix M.

Status of Personnel Trained in Grain Storage and Preservation in Senegal

There are a minimum number of technically qualified grain storage specialists in Senegal. The emphasis in the past has been on groundnut storage and although storage practices are quite similar, storage of cereal grains requires special knowledge.

Probably the best qualified individual in Senegal at the present time is Dr. Gordon Yaciuk. He is stationed at CNRA, Bambey and working on farm storage problems. Dr. Yaciuk is a Canadian on a 2-year assignment with the Ministry of Rural Development.

ITA has a storage section headed by an entomologist who has recently assumed the position. He is assisted by two technicians in presenting "three or four" grain storage training sessions annually for ONCAD personnel. The qualifications of the section leader and technicians are not known.

ONCAD has, under the Direction Technique, a Quality Section with subsections for Seeds, Storage Protection and a Laboratory. The head of the Seeds and Storage Protection subsection has been trained at ITA. At each of the ONCAD regional offices there is a technical group with a Quality Section. Within the Quality Section are a leader and two fumigators per departmental subdivision of the Region. The team was told by ONCAD that these men receive annual training at ITA. Responses to team member questions indicate the fumigators and regional personnel have some knowledge of grain storage preservation, however, certain inconsistencies and the status of grain storage operations indicate the need for improved training and/or opportunity to apply the training.

Only two commercial pest control companies in Senegal are licensed to do fumigations. They include SEAC (Mr. A. Glaszer) and Chimie Afrique (a chemical supplier). Mr. Glaszer is a well qualified fumigator and has a staff of technicians who do custom grain fumigation. From discussions with Mr. Glaszer it is apparent he is aware of the grain storage problems in Senegal.

Commercial warehousing firms, such as SOCOPAO, apparently rely on SEAC for fumigation services when they are used. SENTENAC on the other hand, employs SEAC in fumigation on the docks when necessary but apparently fumigates its own grain at the mill.

SODEVA does have some personnel in the Sine-Saloum region equipped with portable storage fumigation units capable of handling 100 MT of sacked seeds per unit. Qualifications of personnel are not fully known, however, there is evidence the units are probably not being used effectively.

Past, Present and Proposed Grain Storage Training Programs in Senegal

Past Training Programs

USAID recently conducted the following seminar-type training sessions in Senegal which related to post-harvest pest controls.

A seminar in Food Storage and Handling Practices- Dakar, Senegal November 4-8, 1974.

The stated objectives of the Seminar were as follows:

- To create an awareness of the problems associated with the handling and storage of grain and cereal foods. Throughout the seminar the comments were directed to storage and handling at port and warehouse levels. Although

information on village and farm storage was not included, since a seminar on that topic was scheduled for the Sahel area during December of 1974. It was a recommendation of the attendees that this topic be covered in future seminars.

- To enumerate the quality control procedures that are available to determine the safety and nutritional value of food.
- To review the research and development of specialized packaging materials and handling procedures.
- To illustrate the problems and conditions that could contribute to the deterioration of foods.
- To demonstrate the methods, equipment and chemicals that are presently available to aid in the reduction of food losses.
- To instill a desire to improve food storage conditions and handling practices.

Training involved lecture sessions and practical demonstration of techniques. Fifteen African countries were represented. Ten Senegalese took part in the training sessions, primarily representatives of ONCAD.

Institut de Technologie Alimentaire initiated a series of grain storage protection training sessions in 1969. With the financial assistance of IDRC through 1972, ONCAD personnel attended the training sessions. Now ONCAD funds the training of its personnel.

The training sessions included 3 weeks of basic and 3 weeks of practical training in the field.

As an outgrowth of the training sessions held 1969 through 1972, FAO developed and published a training manual[1/] which is quite comprehensive and practical.

[1/] Pattinson, I., J. Deuse, R. DiFuria, F. Manis and I. Diop (1973) Conferences sur les Aspects Techniques et Economiques de l'Entreposage des Grains, Institut Technologie Alimentaire-Senegal. UNCP/FAO, AGS/SEN/64/505, Rapport Interne No. 102, Rome:FAO, 145 p.

Discussions at ITA indicate that training sessions are now 2 weeks basic/2 weeks practical in length.

ONCAD indicated 54 of their personnel have been trained at ITA under this program.

Present Training Programs - The only current training appears to be that of ITA for ONCAD personnel. As indicated in the preceding paragraphs, IDRC funded this training from 1969-1972. Since that time, ONCAD has financed the training of its own personnel. The 6 weeks training formerly provided has apparently been reduced to 4 weeks.

Discussion with ONCAD personnel indicates that all ONCAD fumigators receive annual training.

Proposed Grain Storage Training Programs - Other than the training proposal developed in a later section of this paper, the team is not aware of other new training through the Government of Senegal or donor agencies.

It is assumed that ITA will continue the current training program for ONCAD in the event the program proposed here is not accepted. If accepted, it is presumed that ITA will be involved in the current proposal.

Need for Additional Training - Observations and conclusions made by the team indicate a definite need for additional improved training in the areas of grain storage and preservation. This is especially true in light of the Government of Senegal's decision to enter into a grain reserve program where 200,000-300,000 MT of cereal grains will be stored.

Extent of Losses - At present it is difficult to quote accurate loss figures for cereal grains stored at various levels within the marketing system.

Figures quoted for losses at the farm level range from 1 to 5 percent. Although based on only a minimum number of observations, the team

would agree that losses at the farm level are not an immediate area of concern. Several sources interviewed indicated the same basic conclusion. It seems to be a general concensus that greater losses are being experienced in farm storage of maize and sorghum with estimates by SODEVA of 10 percent. SODEVA and CNRA are currently working on improved farm/village level structures to fit in with the movement toward diversification of cereal grain crops, i.e. increased production of maize and sorghum.

As large quantities of cereal grains are assembled for extended storage, such as the proposed reserve program, the potential for large-scale loss increases unless proper precautions are taken to preserve the quality of the grain.

There are no reliable estimates of losses occurring in present large-scale storage operations such as that performed by ONCAD, SOCOPAO and mills. Team observations indicate the potential for significant losses to occur, especially in ONCAD reserve storage, if improved warehousing and preservation techniques are not implemented.

The same opportunity for losses exists at ONCAD seccos for the same reasons as indicated for ONCAD central and reserve storage facilities.

Benefits to be Derived from Training

It is anticiapted that training as herein proposed would provide the quality managers and technical cadre of the national and regional offices of ONCAD with the basic knowledge and techniques to improve the grain-storage and preservation situation in Senegal. Warehouse managers would also be made aware of the problems involved in maintaining the quality of grains in storage over extended periods of time.

Reduced Losses of Food Grains - By implementing and maintaining an integrated pest management program at ONCAD reserve stock warehouses, it is estimated that losses due to rodents, insects and poor storage and handling techniques can be materially reduced. Assuming an annual loss of 10 percent per year of the proposed 200,000 to 300,000 MT cereal grain reserve would amount to a 20,000 to 30,000 MT loss per year. Through improved storage and handling practices and effective use of pesticides, losses could probably be reduced from 10 to 5 percent. The savings in millet/sorghum food supply would be equivalent to the needs of approximately 110,000 Senegalese.

Reduced Hazard from Pesticides - In the past, heavy reliance has been placed on the use of pesticides in the preservation of cereals and especially groundnuts. Training herein recommended places emphasis on improved grain management through improved inspection techniques, good housekeeping and handling practices, and physical and mechanical control measures and limits the use of pesticides (insecticides and fumigants).

Pesticides are a necessary part of any grain preservation program, however, improperly used they can be a contaminant to the foods they are used to protect and to the environment in which they are used. An effective inspection program will allow for application of fumigants only when necessary and good housekeeping procedures will assure that pesticides that are applied are more effective. Pesticide safety will be a major item of concern.

Lack of Trained Personnel - It may be incorrect to say there is a lack of trained grain storage and preservation personnel in Senegal. ONCAD, for instance, has at least 60 persons who have received ITA training. It may be more correct to say that their training may be inadequate or is not

being properly utilized. Interviews with ONCAD personnel indicate they recognize the general aspects of grain storage and preservation but they do not understand the significance of inspection results, housekeeping functions and how to react with corrective measures. There is also the possibility that administrative and management support is not as responsive as necessary to maintain a good storage and preservation program. Delegation of authority on when to apply corrective measures to central warehouse managers might make the system more responsive.

Monetary Benefits - Limiting the amount of pesticides used will also result in a cost savings. Whereas, previous superficial inspections and poor housekeeping practices may have necessitated frequent fumigations of stored cereal grains, an integrated program, as proposed, would reduce the number of fumigations necessary as well as reducing losses to the grain stocks. For example, if the 300,000 MT grain reserve is fumigated three times during a year the cost in fumigant alone is 157,500,000 CFA, ($730,000.00). One less fumigation per year made possible through improved inspection and housekeeping would result in a monetary savings of 52,500,000 CFA or roughly $240,000.00 per year.

VI. A PROGRAM TO TRAIN SENEGALESE IN GRAIN STORAGE AND PRESERVATION

Although the Senegalese have been exposed to many seminars, both bilateral and multinational, they have not been the type proposed here. The numerous training programs and seminars have, during the past, always focused on the heads of Offices of Cereals, Transporters, Port Directors and chiefs of large urban warehouses. In addition, few Senegalese have attended the seminars as all Francophone countries have been involved.

In a recent IGA Inspection Report dated October 10, 1975, covering AID Drought Relief Programs in West Africa, the IGA has insisted that AID incorporate proper pest control features in the design of any future grain storage and warehouse construction projects that it is considering financing.

The following program is proposed as a means of effectively training key personnel within ONCAD and ITA to provide a nucleus of technically qualified managers and technicians to maintain the Government of Senegal's grain reserve stocks.

The program is designed to inform personnel at all levels within ONCAD (i.e., National Quality to Seccos managers) in the storage techniques and management practices necessary for effective long-term grain preservation.

Technical Assistance

To implement the proposed grain storage and preservation training program, technical assistance will be required by the Government of Senegal in the form of (1) a Grain Storage and Preservation Advisor, (2) training of a

Senegalese Grain Storage and Preservation Specialist in the U.S., (3) Grain Storage and Marketing Short Course training for ONCAD national and regional storage quality personnel and (4) Grain Storage and Marketing Short Course training for the ITA storage section leader.

Grain Storage and Preservation Advisor - It is proposed that a grain storage and preservation advisor be supplied to work with ONCAD in training ONCAD personnel and implementing a sound storage and preservation program.

The Grain Storage and Preservation Advisor will be responsible in Senegal for the following activities:

- Serve as Advisor to ONCAD on problems relating to cereal grain storage and quality preservation.
- Develop a 2-month in-country training program in cooperation with ITA, CNRA and KSU for training a four-man in-country training team.
- Coordinate training of ONCAD reserve, central and Seccos warehouse managers.
- Assist ONCAD in development and implementation of improved storage techniques and facilities.
- Assist ONCAD in development and implementation of effective grain management practices to reduce losses due to insects, rodents and other factors.
- Assist ONCAD in cooperation with ITA in development and implementation of a simple set of grain standards.
- Assist ONCAD in development and conduct of a grain storage loss survey.

It is suggested that the Advisor attend the short course training proposed for ONCAD quality personnel in June-August 1976 and be in Senegal October 1, 1976 to assume his duties as Advisor to ONCAD. It is assumed that the Advisor will work closely with the GOS, ONCAD National Quality Director.

Assistance to Develop Program for In-Country Training Team - It is proposed that Kansas State University under contract AID/ta-C-1162 be involved in the development of a program for the in-country training team, preparation of training materials and conduction of a 2-month period of instruction for the training team.

OVERSEAS TRAINING

Grain Storage and Preservation Trainee (Senegalese) - It is proposed that a Senegalese candidate be selected to receive training in the United States to prepare him for a position as Grain Storage and Preservation Specialist, ONCAD. It is assumed that after training in the U.S., the specialist will assume the duties performed by the Grain Storage and Preservation Advisor and become a permanent member of the ONCAD Quality Staff.

The trainee will need to meet certain qualifications. The trainee should:

- Have the equivalent of a Bachelors Degree in Agricultural Engineering, Entomology or Agronomy and acceptable records to allow enrollment in U.S. universities,
- Be fluent in English. If not, English language training should be provided to pass A.I.D. requirements for U.S. training.
- Have qualities of leadership, initiative and an intense interest in the field of grain storage and preservation.

It is suggested that the trainee attend the Short Course Training herein proposed in June-August 1976 and enroll for a 2-year program in residence at Kansas State University for the fall semester, September 1976. The trainee would be provided sufficient time to complete an M.S. Degree in Grain Storage and Preservation, and be back in Senegal approximately 3 months prior to departure of the Grain Storage and Preservation Advisor.

Grain Storage and Marketing Short Course Training in the U.S. - It is proposed that the ONCAD National and Regional Quality Section Leaders and the ITA Storage and Marketing Short Course conducted at Kansas State University under contract AID/ta-C-1162 Technical Assistance in Grain Storage, Processing and Marketing and Agri-business Development. It is also proposed that the Grain Storage and Preservation Advisor and Grain Storage and Preservation Trainee also attend this short course.

The short course is offered each year from mid-June until mid-August. Lecture, discussion, laboratory, workshop and field trips are included in the training. Course materials are prepared in English, French and Spanish with training in English and simultaneous French and Spanish translation when sufficient participants warrant.

An outline of material covered at the Short Course is presented in Appendix N . A core curriculum is presented on the basics in grain storage and marketing with special emphasis either on the marketing or technical aspects of grain storage depending on participant preference. The participants in this case would pursue the technical emphasis in training.

In total, Short Course training is recommended for the following personnel:

1 - Grain Storage and Preservation Advisor
1 - ONCAD National Quality
6 - ONCAD Regional Quality
1 - ITA Storage Section Leader
1 - ONCAD Storage and Preservation Trainee
1 - Grain Storage and Preservation Advisor.

Three of the ONCAD Regional Quality personnel would attend the Short Course during the second year of the program.

In-Country Training

In-Country Training Team - It is proposed that an In-Country Training Team consisting of four persons be assembled and receive 2 months instruction in grain storage and preservation, training methods, use of audio-visual training aids and demonstration techniques. In cooperation with ITA, C.N.R.A. and KSU, the in-country training team will develop course outlines, manuals and training aids for a series of in-country training sessions to be conducted for:

54 - ONCAD Regional Fumigators
47 - ONCAD Reserve Warehouse Managers
6 - ONCAD Central Warehouse Managers
500 - 600 - ONCAD Secco Warehouse Managers

The Grain Storage and Preservation Advisor, working closely with ITA, should coordinate the training team and utilize ITA, ONCAD and/or C.N.R.A. personnel on the team. ITA has an entomologist in charge of the grain storage section and technicians that could be employed in the training. ONCAD has quality section leaders and/or fumigators that could possibly be used as training and C.N.R.A. has researchers that could be called on to assist in the training.

The training teams should include persons qualified to instruct in the following general subjects:

Insect and rodent biology and damage

Proper storage management and methods

Pest control techniques and equipment

Equipment maintenance and supplies

In-Country Training of ONCAD Personnel - It is proposed that the training team conduct four 1-month training sessions for ONCAD Regional Fumigators and ONCAD Reserve and Central Warehouse Managers; two 2-week Refresher Courses for Fumigators; and twelve 1-week Seminars for Secco

To provide this training a mobile training unit consisting of a vehicle, audio-visual equipment and demonstration equipment will be needed.

Proposed Training Schedule

A flow diagram (Figure 2) has been developed to show a tentative sequence of training activities as proposed in this report.

The schedule provides for seven (7) persons to attend the 1976 AID Grain Storage and Marketing Short Course.

Following the Short Course the grain storage and preservation advisor would proceed to Senegal for a 24-month assignment.

The grain storage and preservation trainee would remain at Kansas State University to complete 24 months training and earn a Master's Degree in Grain Science.

The ONCAD Director of Quality would visit grain storage and marketing functions in the United States prior to returning to Senegal on completion of the Short Course.

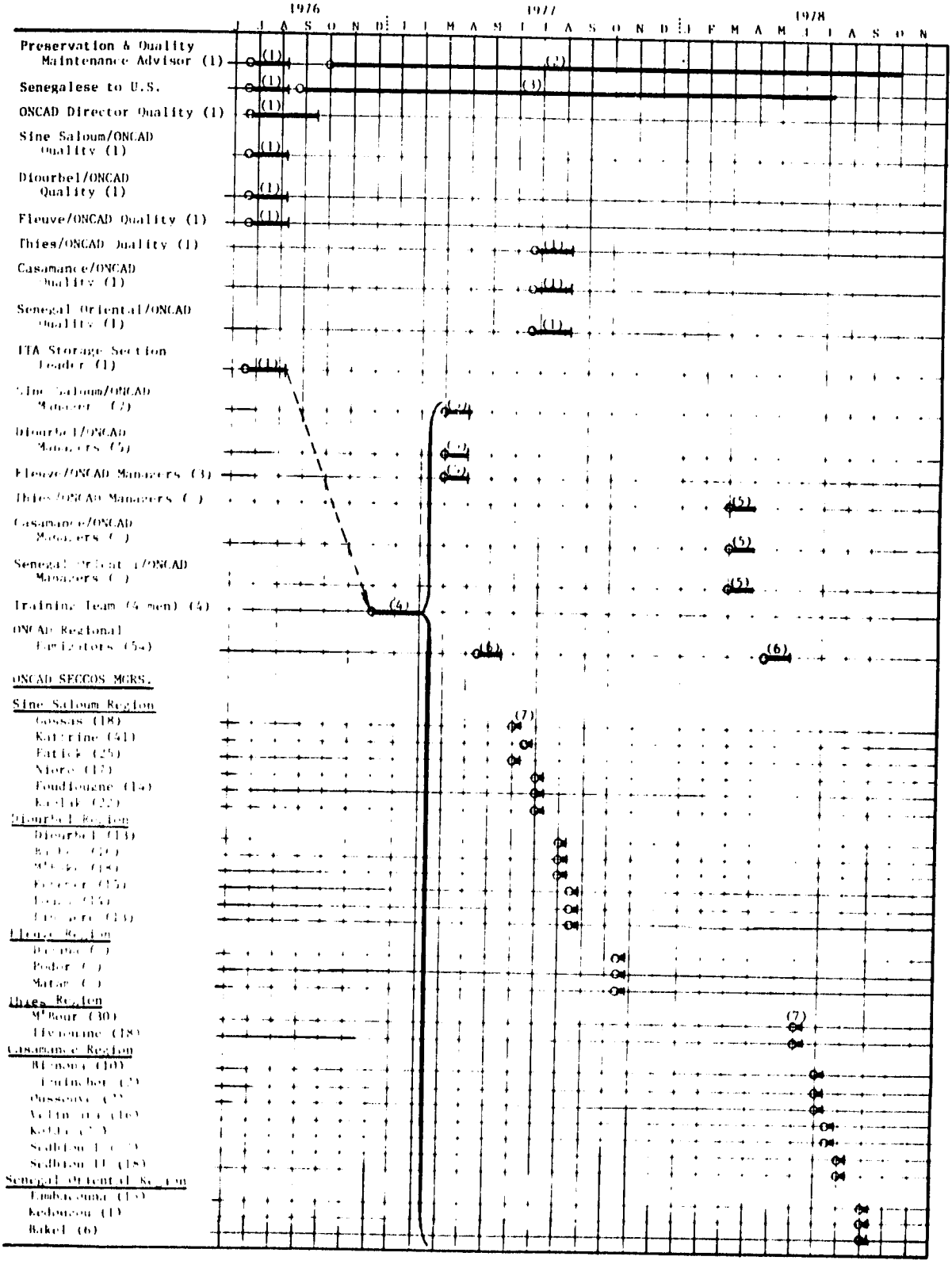
ONCAD Regional Quality personnel from the three Regions where AID has or proposes production and/or warehouse construction activities (Sine Saloum, Diourbel, and Fleuve) would return to their respective offices following the 1976 Short Course. Regional Quality personnel from the other three (3) Regions would attend the 1977 AID Grain Storage and Marketing Short Course.

The ITA Storage Section Leader would return to his duties at ITA following the 1976 Short Course and hopefully start preparations for the two (2) month program to prepare an In-Country Training Team.

The In-Country Training Team would be assembled in December 1976 and under go two (2) months training and preparation for conducting in-country seminars for ONCAD Regional warehouse managers, ONCAD Secco Managers and ONCAD fumigators. Training of the Regional warehouse managers from Sine

PROPOSED
GRAIN PRESERVATION AND QUALITY MAINTENANCE
TRAINING SCHEDULE

FIGURE 2



FOOTNOTES:

(1) AID Grain Storage and Marketing Short Course, Kansas State University.

(2) Grain Preservation and Quality Maintenance Advisor in Senegal.

(3) Senegalese Trainee in Grain Preservation and Quality Maintenance at Kansas State University.

(4) Preparation of a four-man Senegalese training team in Senegal (in cooperation with KSU, ITA, CNRA and Advisor).

(5) Grain Preservation and Quality Maintenance Seminars in Senegal for ONCAD Warehouse Managers.

(6) Grain Preservation and Quality Maintenance Seminars in Senegal for ONCAD [illegible]

Saloum (7), Diourbel (5) and Fleuve (3) would take place at a central location, probably ITA or C.N.R.A. The same would be true of training for the ONCAD fumigators.

Seminars for Secco managers would be held in the various Regions and/or Districts where the Secco's are located.

Estimated Cost of Proposed Training Program

Grain Storage and Preservation Advisor - It is estimated that it will cost approximately $16,000 to support the 24-month training of a Senegalese who will eventually assume the duties of the grain storage and preservation advisor in ONCAD.

Grain Storage and Marketing Short Course Training - Estimated cost per participant for Short Course training is approximately $6,000. A total of 10 persons are proposed for this type of training at a total cost of $60,000.

In-Country Training - In-Country training includes costs for assemblying and preparing the Four Man Training Team, providing and equipping a mobile training unit, and maintaining the training team for approximately 24 months. Estimated cost for in-country training is approximately $215,000.

Total Estimated Cost - Total estimated cost of the training program could be expected to be between $450,000 and $500,000.

APPENDIX

APPENDIX A

PRESENTATION NOTES OF THE AGRICULTURAL LAW-PROGRAM

Goal

Sponsored by the Prime Minister, the agricultural law-program has as its goal, to facilitate the financing of investments intended for the gradual resorption of the food deficit. It will be complemented with actions seeking to solve some particular problems, such as the shortage of sheep for the Tabaski (religious celebration) and the satisfaction of the domestic needs for tomato concentrates.

This law finally deals with a reafforestation program for the protection of the environment.

Method of Elaboration

First of all, a forecast of the national needs for the 1976-77 (end of 4th Plan) 1980-81 (end of 5th Plan), 1984-85 horizons and the long term horizon of the year 2000.

Then a global analysis of the national production capacities that will be articulated to satisfy their needs. Given these capacities, certain medium term objectives were set.

Finally an investment strategy was elaborated in order to reach these objectives.

The law includes two types of investments:

Direct investments: Their realization will increase the national production capacity.

Supporting investments: Necessary in order to guarantee the program's efficiency. These supporting investments will deal with the protection of the soil through reafforestation, with technical studies for the search for water, finally with agricultural projects development.

Reference: No. 02256/MDRH/CT 4, Dakar 10 Apr. 75
Ministre du Développement Rural et de l'Hydraulique,
République du Sénégal.

An important remark to put this law-program into perspective:

It was conceived to serve as complementary financing to aid from foreign governments. That's why a number of cereal development programs are not mentioned here, because they are financed through outside help. The cereal development program (corn included) for the peanut belt, for example, is financed through loans from the World Bank, the EEC, USAID and the National Investment Budget, the Eastern Senegal Rice Development Program is financed by the European Development Fund, Rice growing in Sedhiou, Casamance by the World Bank and the Delta by the AID and Development Fund (French).

This law-program was then conceived as, on the one hand, complementary financing for projects that have not yet found financing from the outside (corn operation in Eastern Senegal and Casamance, sheep development operation, reafforestation actions) and on the other hand, as a means of accelerating other programs that might find outside financing, but not in the immediate future (the South Kasak Bassin Development).

FORECAST OF NATIONAL CEREAL DEMANDS AND CAPACITIES OF THE OFFER

A preliminary evaluation of the national consumption was made for the 5 years going from 1969 to 1973. For 1973 the breakdown is as follows:

Wheat	22.7	kg/year/inhabitant	
Corn	14.35	"	"
Rice	80.85	"	"
Millet and sorghum	114.89	"	"

We notice that this national consumption has changed very little during that time except for millet and sorghum where because of the drought the consumption went down from 137 kg/year/inhabitant in 1969 to 114.85/kg/year/inhabitant in 1973.

The imports for that last year were as follows:

Wheat	105.422 tons	
Corn	51.453 tons	
Rice	295.629 tons	(equipment in paddy)
Millet and sorghum	41.402 tons	

COMPREHENSIVE PROGRAM OF ACTIONS TO BE TAKEN

Cereal programs	Research program	Seed Program	Provisioning program	Development program for realization studies
Actions millet and sorghum	Continued Researches GAM millet Souna II Short cycle sorghum	Multiplication of varieties with high yield	Increased use of termaire fertilizers	
Financing	ISRA Bank	Seed service bank	LPA subsidy	
Actions Rice (Wheat)	Continued researches	Multiplication of varieties	Increased use of fertilizers	Nianga Tellel Matam Grande Bakel digue Other developments
LPA Financing	ISRA Bank	SAED SODEFITEX Seed Service	F.M.D.R.	LPA SAED FAC-IDA FED-USA
Actions Corn	Research on varieties	Creation of a seed farm corn	Increased use of fertilizers	
LPA Financing	ISRA Bank	LPA	F.M.D.R. budget	
Actions Industrial Tomatoes	Continued researches on varieties		Use of fertilizers and nematocides	South Kasack (500 km Dagana)
LPA Financing	Camberene ISRA and SAED	SAED	SAED	LPA IDA

Production technical program	Storage program	Transport program	Transformation program	Studies program
Intensification of the popularization program SODEVA	Increase of storage capacities		ITA program on seminola and couscous	Economic study of agricultural development alternatives
SODEVA budget Generalizing draw cultivation	LPA ONCAD	ONCAD	ITA budget Shelling	LPA Econ study of agricultural development alternatives
- SAED - SODEFITEX - Casamance projects SODEVA and SODEFITEX reinforcement action (Sine Saloum)	Projects Creation of a storage capacity	Roads and secondary roads project Trucks	SAED SODEFITEX project Pealing plant	
SODEVA budget SAED staffing	LPA	LPA	LPA - SOCAS - Dagana and - Sine Saloum projects	LPA Italconsult
			- stabilization coffer - Italy Germany	

Despite importations, the total amount available per year and per inhabitant has remained inferior to 250 kg, an amount that represents the average consumption level.

The following table summarizes the probable evolution of the national needs up to the year 2000. It is based on an average consumption of 250 kg/year/inhabitant and the assumption will remain constant. This hypothesis might be false in the long run, but is true in short and medium term.

Note: Hyp. D. (Demographic) indicate two demographic increase hypothesis: 2.2 and 2.5%

Cereal Hypoth.	Demogr. Hyp.	76/77	80/81	84/85	2000
Total amount of cereals	2.2%	1,103,000	1,202,750	1,312,500	1,879,000
250 kg stability	2.5%	1,118,750	1,235,500	1,304,000	2,075,250
Millet and Sorghum 127 kg	2.5%	562,864	610,997	666,750	954,786
	2.5%	568,325	627,634	692,912	1,054,227
Rice 85 kg	2.2%	327,020	408,935	446,250	639,030
	2.5%	380,375	420,070	463,760	705,585
Corn	2.2%	66,180	72,165	78,750	112,770
	2.5%	67,125	74,130	81,840	124,515
Wheat (23 kg)	2.2%	98,936	110,653	120,750	172,914
	2.5%	102,925	113,666	125,488	190,983

The following series of tables indicates the foreseen supply capacity for the different cereals.

They were made according to projects going on at the present time and other projects already elaborated and to be completed during the 4th and 5th Plan.

3.3.2.2. Corn-Horizon 1980-81

Projects	Ha	Average yield	Total yield	Observations
Traditional production				
-Casamance	20,000			
-Eastern Senegal	13,000			
-Other regions	5,000			
	38,000	0.8	30,400	
Sine Saloum Project	10,800	8.36	25,500	Managed by SODEVA
Eastern Senegal and Upper Casamance Projects	16,000	2.5	40,000	Managed by SODEFITE
Total	64,800	1.48	95,800	

3.3.2.3. Wheat in 1980

Projects	Ha	Average yield	Total yield	Observations
SAED wheat	5,000	3 T	15,000	

3.3.2.4. Millet and Sorghum in 1980

Projects	Ha	Average yield	Total yield	Observations
Irrigated crops				
SAED Sorghum	10,000	2 T	20,000	
Dry crop culture				
Traditional Millet and Sorghum	500,000	0.5 T	300,000	
Traditional Millet and Sorghum	400,000	1 T	400,000	Farmers supervised by SODEVA, SODEFITE and the Casamance
Total	1,000,000	712 kg	720,000	

If all projects to be developed are normally completed, the cereal deficit of the country will totally be resorbed by 1981. One must, however, keep two important points in mind.

1) As far as rice is concerned, the national needs will be covered only if the SODAGRI Project of 25,000 hectares is actually completed. If it is only partially realized, it will be necessary to accelerate the development of new areas in the river valley, in order to make up the difference.

2) For wheat, it will only be possible to cover 15,000 T of the total need, the culture of wheat being possible only on part of the land on the river valley, and being moreover limited by the quantities of water available in the dry season.

The national need in wheat will only be covered after the Manantali Dam is completed.

The needs for corn will, however, be covered to 131 percent and for millet and sorghum the coverage will reach 116 percent.

The evaluations are based on the present structures of cereal consumption.

Source: Project de synthèse du travail du groupe loi-programme de l'Alimentation au Sénégal. Mars 1974. Groupe d'Etudes sur la loi-programme de l'alimentation.

GOS MARKETING POLICY BACKGROUND PAPER

The ONCAD has been chosen by the Government to execute the project.

II. - Marketing Policy

The cereals marketing program under ONCAD has to satisfy the following requirements:

- Setting up of a marketing network adapted to the production structures.

This marketing network should essentially be used to:

(a) Increase the value of the production at the market price set by the Government;

(b) Eliminate speculators from the market (in earlier speculative markets, the producer caught up in a situation where they needed money badly, were compelled to sell a good part of their production at low price at the beginning of the harvest period);

(c) Constitute and maintain stocks in marketing areas (the closest possible to the production areas) in order to forestall the lack of foresight on the part of some producers, and also to provide guard against shortage of between-crops food reserves in so-called production areas.

(d) Harmonize stocks movements with the millet and sorghum. That is either imported or given to Senegal by this project or other sources.

(e) Set up a distribution network that makes it possible to have a balanced food distribution between the zones with an excess of food and those are deficient and also with the urban areas.

(f) Efficiently supply industrial transformation programs, in cereals. In this area a good possibility for expanding production will be furnished by the project developed by the Institute for Food Technology.

- Produce couscous and semolina

(g) Set up a storage network for long-term storage, intended for the regrouping and conservation of excess cereal produced.

(h) Develop an efficient transportation program that will help reduce costs and will also provide extra transportation possibilities for the primary and secondary automotive pools.

III. - Definition of means for Short-Term Action

A. Marketing Structures

To complete this project ONCAD will utilize all the existing marketing structures.

The Coops Structures A vigorous action to make coop-organizations aware of the project and get them interested in it will enable us to make use of a marketing network that already is in place and is wide-spread. These coops, that have so far devoted themselves only to marketing peanuts, will have from now on to open themselves up to a new multi-functional conception of their activities, thus creating for themselves new resources and a more stable economic basis.

Their location pattern on the national territory presents two aspects:

(a) The zones of the peanut belt is totally covered.

(b) The so-called peripheral zones, where the coverage is looser, will necessitate a restructuration based primarily on cereal programs that will serve as a commercial support.

The setting up of this network will give the project important means of intervention that will enable it to effect the marketing control by the presence on the market of the producers through their cooperatives. The coops will be supervised and supported by the project. Beyond providing that network, the organization by cooperative will also furnish the project with the necessary funds to:

- Complete a 5 year medium-term program of family size silos through the agricultural loan program, thus opening new possibilities in the area of individual equipment.

- Create first an investment credit for collective equipment, second a series of new possibilities through the use of the common investment fund that will enable the cooperatives to actively participate in a medium-term investment program to build marketing facilities with financial assistance provided by the project.

ONCAD's Direct Intervention Structures

The structures are represented:

(a) by the ONCAD "seccos" (storage facilities that can serve in all the areas as marketing units that will be ONCAD's own).

(b) the ONCAD collecting points representing marketing units located in a determined area and making it possible to satisfy the needs in distribution structures for the products and functioning temporarily for a given objective.

ONCAD has therefore, because of its statutory prerogatives, the possibility of intervening in the area of marketing to supplement cooperative and government structures in case of insufficiency.

Intervention of the Private Sector The intervention of private businessmen must form the subject of an agreement subject to ONCAD's advice. In the future, their activities must be subjected to a permanent control to avoid any deviation from the stabilization policy being implemented and for which their actions should be complementary to the project's own.

B. Organization of Marketing Services at the National Level

The realization of the project will be effected by the marketing office (of the Ministry) which with the help of the experts will formulate the course action on the basis of a coherent application of the policies and will define the means that will be articulated.

This will necessitate the setting up of a cereal office -- called earlier -- office of secondary marketing -- that will be in charge of the execution and follow-up of marketing operations, of collecting all cereals produced by the project, and on the other hand of organizing their distribution in rural areas by coordinating the different actions, to the satisfaction of all needs and at the most favorable economic costs possible.

The service will be effected by:

- an officer of deputy rank (senior officer) having solid knowledge of marketing organization, financing and stocks management;

- three controllers in charge of control of the execution of marketing operation and stocks management, academic level, brevet supérieur de commerce or accountant with solid knowledge in stock management;

- an accountant in charge of stocks movements and accounting; he will record the data collected and after verification will supply every month a situation report of the accounts and of the stocks at regional and national level.

At the Regional Level The chief regional manager will be responsible for execution of the project. At this level will be created a regional marketing office the size of which will depend on the development of cereal production in the area. At the outset, the project will use the existing marketing structures for the financing of purchases and the collecting of the documents according to the existing procedure UPC-COR or ABD-DAC-AC. The information and documentation elements are afterwards sent to the DIG/COM, which after verification transmit them to the accounting department.

An appropriate procedure will be developed.

- A regional assistant will be in charge of the Cereal Office, representing the decentralization of the national structures.

At the District Level To start the project, the heads of COR and UCP will effect all the operations of verifications and the control of the quantity and quality of commercializad products and also the execution of directives at the primary level. They will report every week, through the established channels to the regional manager that will transmit to the head office -- Marketing Department.

IV. Technical Assistance

The technical help will be supplied by the ONCAD technical department in rapport with the ITA.

National Level The technical department is responsible for studies to, on the one hand satisfy the quest for technical solutions to be articulated for the realization of storage facilities, equipment and their maintenance; and on the other hand to develop and apply the conservation techniques and to train officers.

Regional Level The regional technical department will organize the treatment programs. It will also periodically inspect the stocks to inform itself of their phyto-sanitary conditions, in order to take the necessary action to avoid all risks of infestation.

V. Storage Infrastructures

The Storage Infrastructures for Basic Marketing

The ones presently existing are both summary and insufficient to insure the marketing. It will be necessary to use, in the immediate period, the means that are available in areas where the marketing takes place, thus avoiding costly transportation. It will be made use of stores or premises fulfilling the following criteria: walls in bricks, cemented floor, water-tight roof, robust doors and allowing a good protection and also a good ventilation.

In the immediate period, these premises will be used in the most rational way possible by paying a monthly rent of about 4,000 to 5,000 F/CFA to store 30 to 50 tons of millet, which amounts to about 1,000 to 1,500 CFA per ton per crop season (10 months, average).

For the coming crop season a study should be made of the means to use in order to solve that problem.

The Large Capacity Storage Facilities

ONCAD has presently a group of warehouses capable of being used for regrouping of cereals; a study of the most rational way of using them will be done. These facilities of different capacities are broken down as follows:

(a) Premises belonging to ONCAD

-Ziguinchor	2,000T
-Kaolack	13,000T
-Thiès	2,000T
-Dakar	8,000T

(b) Renting possibilities

To supplement this storage set-up, which for the most part could be found inadequate both for the geographical distribution and the technical and economic requirements of the stabilization program, a prospectus will be made of the possibility of renting space. Some information on this is given here for information:

Casamance Region	Velingara	1,000 T
	Kolda	1,000 T
Diourbel Region	Diourbel	1,000 T
Fleuve Region	St. Louis	2,000 T
	N'Dioum	200 T
Sine Saloum Region	Koungheul	200 T
	Kaffrine	500 T
Eastern Senegal Region	Tambacounda	1,000 T
	Koussanar	200 T
	Total	7,100 T

VI. Realization of the New Infrastructures

The realization of new storage facilities, adapted to the basic structures, is the determining factor for the success of stabilization policies.

These policies should be conceived according to norms studied for the different execution studies of these policies and that are represented by:

1) Family type silos of small capacities: 2 to 3 T divided in compartments for a diversified use. As soon as the studies made by SODEVA and IRAT are completed, this type of silo can be integrated to the agricultural program depending on its cost.

A certain amount of popularization will be done with financing from the program in different locations.

2) The storage warehouses at the so-called primary marketing: These warehouses of various capacities, from 50 T to 300 T will be conceived to store bagged grains, at the coop level. Their location should take into account the marketing capability of the coop, that must have a vocation having to do with handling cereals. These warehouses should follow these criteria:

   a. to be used for storage of bagged grain in order to take into account the present handling and transportation restraints, with all possibilities of diversified utilization.

   b. possibility of reconversion for bulk storage which is the final objective of the project and that should be realized as soon as the appropriated transformations of the technical means and the equipment for the transportation and the handling of bulk grain are realized. The financing of these infrastructures should be looked for in the scope of this project.

3) The warehouse/silos of various capacities for the regrouping and the long-term storage. These facilities should be located in areas of heavy production and in Dakar according to their capacities.

   a. Warehouses of 1,000 to 5,000 capacity

      - in Casamance: in heavy production areas of the border zone with Sine Saloum;

      - in the Fleuve or in Diourbel area, to service the entire northern part of Senegal;

      - in eastern Senegal: in the area bordering on the railroad and in areas that are isolated during the rainy season.

   b. Large capacity warehouses 10,000 to 15,000 T

      - in Dakar in areas close to the harbor and susceptible of satisfying the needs of importation of cereals in bulk.

The program for realization of this type of facility will be given in annex.

VII. Training Program

A program will have to be formulated at 3 levels -- level of senior officers responsible for the definition of policy application, for evaluation of the financing program and for the resources.

a. Senior officers:

- a project director
- a deputy director in charge of the Cereal Office
- a management controller

b. Medium-level officer in charge of executing the "medium-level officer-technical agents." Programs.

c. Level of executing agents - Warehouse manager.

VIII. Marketing Program for the 1973/74 Crop Season

While the first early millet harvests were satisfactory, harvest of other varieties of long-cycle millet are very much endangered by the drought that has occurred at the end of the rainy season.

In some areas of the peanut belt: Diourbel, Fleuve, Siné-Saloum and Thiès, the harvest of these long-cycle varieties, will be very small and the necessity of an immediate intervention to satisfy the needs for food is already felt in areas hardest hit.

It will, therefore, be necessary starting in this crop season to promote and to articulate the stabilization program by marketing the excess in grain of good production areas to the benefits of the needy zones (zones with deficit harvest).

IX. The Harvests and Marketing Forecasts

Breakdown:

Cap Vert	360 T	
Casamance	91,000 T	
Diourbel	101,000 T	
Fleuve	13,000 T	
Eastern Senegal	35,000 T	
Siné Saloum	180,000 T	
Thiès	62,000 T	
Total	482,360 T	(roughly 480,000 T)

Based on these harvest forecasts, the marketing program will be established as follows:

Cap Vert	0 T
Casamance	3,500 T
Diourbel	6,800 T
Fleuve	200 T
Eastern Senegal	5,000 T
Siné Saloum	6,000 T
Thiès	3,500 T
Total	25,000 T

The effort to market this will essentially concentrate on the Souna millet and will emphasize in good production areas both the establishment of efficient redistribution circuits and the fight against speculating traders who feed the illicit markets and the illegal exportation toward bordering markets.

X. The Financing

The financing for the commercialization project will be effected by the consortium loan to ONCAD, that was given by a consortium of banks, the leader of which is the BNDS.

The necessary funds for the marketing project (625,000,000 CFA) are available.

It will, however, be necessary with this project to study whether any possibility exists of intervening in the financing to minimize the financial

costs by using funds available in the special account or through financing from other resources.

XI. Marketing Set-Up

As earlier indicated, the use of the coop organizations as basic structures for marketing activities remains the goal of the project.

Measures will be taken so that as early as the next crop season, the coops will take over the cereal marketing. Consequently, the principle has been agreed upon that wherever the coops are capable of normally functioning, the ONCAD "seccos" will cease to function.

This will make it possible:

a. to locate marketing points near the production areas, in order to better control cereal movements;

b. to effect, before the end of the project, a functional location pattern capable of serving as a support to any clean-up action of the marketing circuits, and also to realize our goal of cereal stabilization;

c. to allow the coops to take advantage within the framework of the national agricultural loan program of the volume of cereals to be marketed in order to improve their credit capability to the benefit of more consequent individual equipment for the cereal producers. This in return will have a favorable effect on cereal production;

d. to make more real the participation of coops in the investment effort for the creation of marketing and storage facilities, and to make them more profitable by:

- a rational utilization of the common investment fund
- creation of multiple functions in storage, supply for the distribution of first necessity products
- creation of new resources that will make it possible to give the most dynamic coops, permanent managers.

On the other hand, we must take note of as an advantage of this orientation:

1) The participation of the coop in creating a more responsible management at the gathering level. This participation is guaranteed by the anti-fraud deduction of 1 CFA per kg of marketed millet or sorghum. Indeed, this anti-fraud deduction will cover all losses due to poor quality of delivered products not imputable to the manager or the cooperative president. It is given back to the producers after total delivery and control of the quality and after deduction for rehandling for any defect or presence of impurities over the accepted norm. This will get the farmers more attentive to the marketing process and more willing to take a more direct control of it.

2) The involvement of coop presidents in the profit sharing scheme by payment of the marketing bonus is also a factor in encouraging them to exercise their control power within the cooperative.

XII. The Producer's Price

The producer's price fixed at 25 F.CFA/kg will certainly be a more real encouragement factor to production. It can be broken down as follows:

- installment on producer's price to be paid cash and on all quantities bought:	24 F.CFA/kg
- anti-fraud withholding to be freed as refund to the producers at the end of operation, after verification, quality control, and rehandling resulting from it and not imputable to managers and coop presidents:	1 F.CFA/kg
Thus, price/kg to the producer:	25 F.CFA/kg

XIII. Estimated Cost Price

The computation of the cost price was done as follows:

- purchase price of 25,000 T at 25 F.CFA/kg	625,000,000 CFA
- insurance at 25 F.CFA/ton	625,000
- cost of setting up funds	1,413,000
- financial costs (7 months)	37,335,000
- presidents' bonus (0.10 F/kg)	2,500,000
- weigher's remunerations (0.20 F/kg)	5,000,000
- storage losses (2% of selling price 32 F/kg)	16,000,000
- bags (250,000 bags at 200 F/piece)	50,000,000
- treatment costs and fumigation	17,000,000
- participation to ONCAD's general costs	28,000,000
- transportation and handling costs (2,400 per ton)	60,000,000
- mecanography cost	1,700,000
	875,706,000 CFA

which comes up to the cost price of 35,028.25 F.CFA per ton.

The selling price for the producer having to be fixed at 32 F/kg, which amounts to 800,000,000, we must register a marketing loss of 75,000,000.

To cover this loss, sums of money must be found in agreement with the Government in the project resources.

A special effort will be made on financial cost, storage doors, transportation costs in order to utilize as much as possible the project resources for profitable investments, i.e. realization of storage infrastructures and means of treatment.

XIV. Transportation and Handling Costs

Production in this crop season is normal in so-called border areas of Casamance and Eastern Senegal and medium in the Peanut Belt where there are areas hard hit by the end-of-cycle drought, in the areas:

- North of Siné Saloum and Diourbel Regions
- South of Thiès Region
- On the whole territory of Fleuve and Cap-Vert Regions.

To satisfy the needs in these areas (we must add to them the urban areas), it will be necessary to transfer part of the production from far-away

areas where production was normal (specially Casamance, Eastern Senegal, the Southern part of Siné Saloum Region) to zones that have a deficit.

Our forecasts for transportation and handling are as follows:

5,000 T to carry on long distances (Casamance, Eastern Senegal to the Northern Areas: Louga, Lingere, Kebemer, Fleuve area) at the average price of 7,000 F/ton	35,000,000 CFA
5,000 T to carry on intermediate distances at 2,200 CFA/ton	11,000,000 CFA
10,000 T to carry on short distances for charges and regrouping (consolidation)	12,000,000 CFA
5,000 T will be moved in case storage facilities exist locally but need handling (repairs)	2,000,000 CFA
Global transportation costs which means 2,400 CFA per ton	60,000,000 CFA

This area will be the subject of particular attention in terms of the evolution of marketing in different areas.

APPENDIX C

PRODUCTION DATA 1964-1969

Land Area and Production of Millet and Sorghum in Senegal by Region and Department

Region and Department	1964-1965 Land Area (Ha)	1964-1965 Production (Tons)	1965-1966 Land Area (Ha)	1965-1966 Production (Tons)	1966-1967 Land Area (Ha)	1966-1967 Production (Tons)
SINE-SALOUM						
Kaolack	46,500	26,900	49,000	29,400	49,500	23,350
Kaffrine	72,500	47,145	80,000	52,000	87,000	47,800
Gossas	47,000	23,500	48,500	24,250	37,800	15,970
Fatick	65,600	32,800	66,000	33,000	57,000	22,900
Foundiougne	20,020	12,012	21,500	12,900	22,520	11,258
Nioro	46,900	30,485	50,000	32,500	54,500	27,250
Region Total	298,520	172,818	315,000	184,050	308,320	148,528
THIES						
Thies	37,000	11,100	39,000	15,600	39,000	9,356
Tivaouane	57,000	16,200	61,000	18,300	69,000	14,265
M'Bour	45,000	15,750	47,000	18,800	37,875	18,310
Region Total	139,000	43,050	147,000	52,700	145,875	41,931
DIOURBEL						
Diourbel	47,000	30,400	52,000	26,000	55,000	5,500
Bambey	70,000	36,500	77,000	37,000	71,000	10,650
M'Backe	18,000	7,000	20,000	8,000	22,000	6,600
Kebemer	86,500	36,200	88,000	35,200	47,000	18,800
Louga	35,000	6,300	38,000	7,600	35,650	5,300
Linguere	28,500	8,500	30,000	9,000	27,600	6,900
Region Total	285,000	124,900	305,000	122,800	258,250	53,750
FLEUVE						
Dagana	37,000	18,400	37,000	19,000	41,710	15,706
Podor	50,000	27,600	52,000	17,800	38,117	16,236
Matam	35,000	19,200	33,000	16,050	43,274	20,960.8
Region Total	125,000	65,200	122,000	52,850	123,101	52,903
SENEGAL ORIENTAL						
Tambacounda	20,500	15,300	25,000	17,500	27,702	17,629
Bakel	16,000	10,500	18,000	13,500	18,685	12,145
Kedougou	23,000	16,000	24,000	15,600	25,250	20,200
Region Total	59,500	41,800	67,000	46,600	71,637	49,974
CASANANCE						
Ziguinchor	4,018	3,512	5,000	3,500	4,906	2,987
Oussouye	202	141	400	260	283	52.5
Bignona	27,100	21,680	26,000	22,800	15,293	8,353
Sedhiou	41,171	33,256	45,000	38,250	37,093	34,552
Kolda	15,375	15,375	16,000	13,600	19,655	20,923
Velingara	15,000	9,750	20,000	16,000	11,081	9,159
Region Total	102,866	83,714	112,400	94,410	88,311	76,026
CAP-VERT						
Cap-Vert	932	280	990	346	1,023	336
National Total	1,010,818	531,762	1,069,390	553,756	996,517	423,448

1967-1968		1968-1969		Five-Year Average		
Land Area (Ha)	Production (Tons)	Land Area (Ha)	Production (Tons)	Land Area (Ha)	Production (Tons)	Yield Ton/Ha
50,950	27,470	52,050	23,645	49,600	26,153	.527273
95,200	56,400	90,400	44,945	85,020	49,653	.584016
54,575	20,830	52,700	19,179	48,115	20,745	.431154
67,300	34,100	66,950	25,299	64,570	29,621	.458727
24,540	14,720	25,340	15,196	22,784	13,217	.580100
59,900	34,250	58,890	27,387	54,038	30,374	.562085
352,465	187,770	346,330	155,651	324,127	169,763	.523754
39,100	16,135	38,600	11,820	38,540	12,802	.332174
75,000	30,000	65,000	16,750	65,400	19,103	.292095
49,000	22,150	51,500	16,571	46,075	18,316	.397526
163,100	68,285	155,100	45,141	150,015	50,221	.334773
50,000	30,000	42,700	16,145	49,340	21,609	.437961
80,000	48,000	63,600	15,300	72,320	29,490	.407771
17,000	6,800	22,000	6,950	19,800	7,070	.357071
85,000	42,500	56,000	22,400	72,500	31,020	.427862
38,000	19,000	41,000	7,000	37,530	9,040	.240874
30,000	12,000	30,500	9,911	29,320	9,262	.315996
300,000	158,300	255,800	77,706	280,810	107,491	.382799
38,516	15,851	34,115	7,174	37,668	15,226	.404215
45,268	28,034	34,039	12,116	44,485	20,357	.457614
56,279	28,731	38,592	18,547	41,229	20,698	.502025
140,063	72,616	106,746	37,837	123,382	56,281	.456152
28,578	18,577	29,739	19,330	26,304	17,667	.671646
19,618	14,713	16,786	5,254	17,818	11,222	.629812
25,250	30,200	25,502	20,401	24,600	18,480	.751219
73,446	53,490	72,027	44,985	68,722	47,369	.689284
5,868	3,950	5,473	4,353	5,053	3,660	.724401
		189	143.5	215	119	.554935
18,292	12,890	12,489	9,920	19,835	15,128	.726730
55,410	51,736	50,567	33,733	45,848	38,305	.826758
20,376	22,267	19,415	18,500	18,164	18,133	1.081650
25,200	23,205	24,860	21,339	19,228	15,891	.826421
125,146	114,048	112,993	87,988	108,343	91,236	.849396
1,145	451	691	134	956	316	.323272
1,155,365	654,960	1,049,687	449,459	1,056,355	522,677	.494792

Land Area and Production of Paddy Rice
in Senegal by Region and Department

Region and Department	[illegible]-[illegible]55 Land Area (Ha)	[illegible]-[illegible]55 Production (Tons)	1965-1966 Land Area (Ha)	1965-1966 Production (Tons)	1966-1967 Land Area (Ha)	1966-1967 Production (Tons)
SINE-SALOUM						
Kaolack	90	43	20	12	20	9.5
Kaffrine	--	--	--	--	--	--
Gossas	--	--	--	--	--	--
Fatick	5,450	2,920	4,700	2,820	3,880	2,328
Fondiougne	1,450	1,235	1,200	1,080	625	602.5
Nioro	520	696	600	720	22	21.9
Region Total	7,510	4,894	6,520	4,632	4,547	2,961
THIES						
Thies	140	196	145	145	245	228
Tivaouane	25	35	25	25	27	27
M'Bour	320	303	300	240	338	299
Region Total	485	534	470	410	610	554
DIOURBEL (Negligable Production)						
FLEUVE						
Dagana CMS			192	593		
Dagana SAED			5,900	11,210	9,300	22,065
Dagana SDRS			5,600	14,000	4,890	12,835
Dagana Total	(8,855)	(21,171)	(11,692)	(,803)	(14,190)	(34,900)
Podor Colonat			290	638	272	688
Podor O.A.V.			536	1,072	1,102	2,605
Podor Total	(284)	(802)	(826)	(1,710)	(1,374)	(3,393)
Matam	--	--	---	--	--	--
Region Total	9,139	21,973	12,518	27,513	15,564	38,293
SENEGAL-ORIENTAL						
Tambacounda	150	120	200	160	232.1	185.68
Bakel	178	107	200	60	388	84
Kedougou	1,200	1,200	1,250	1,250	1,285	1,144.36
Region Total	1,528	1,427	1,650	1,470	1,905	1,414
CASAMANCE						
Ziguinchor	5,662	6,228	6,500	7,150	7,784	7,784
Oussouge	11,195	13,434	10,000	12,000	8,903	9,340
Bignona	26,460	38,466	26,500	37,100	20,418	26,098
Sedhiou	14,371	19,939	16,000	22,400	18,400	27,601
Kolda	7,914	8,317	6,000	6,000	8,493	9,706
Velingara	2,332	2,799	3,000	3,600	1,350	1,687
Region Total	67,934	89,183	68,000	88,250	65,348	82,216
CAP-VERT						
Cap-Vert					110	78
National Total	86,596	118,011	89,158	122,275	88,084	125,516

1967-1968		1968-1969		Five-Year Average		
Land Area (Ha)	Production (Tons)	Land Area (Ha)	Production (Tons)	Land Area (Ha)	Production (Tons)	Yield Tons/Ha
28	22.4	29	10.4	37	19	.513369
--	---	--	--	--	--	--
--	--	--	--	--	--	--
2,405	1,785	--	--	3,287	1,970	.599513
1,080	957	--		871	775	.887250
45	41	35	9	244	298	1.217670
3,558	2,805	64	19	4,439	3,062	.68971
154	317	259	310	189	239	1.26820
28	28	30	27	27	28	1.05185
342	338	365	283.5	333	293	.87867
524	683	654	620.5	549	560	1.02114
				38	119	3.08854
10,257	15,453	816	506.1	4,655	9,847	2.11579
4,890	12,835	5,000	10,000	4,064	9,934	2.44438
(15,147)	(28,288)	(5,816)	(10,506.1)	(11,140)	(24,134)	(2.1663)
280	690	570	1,348	282	673	2.38243
773.25	2,010.45	77	183.1	498	1,176	2.35932
(1,053.25)	(2,700.45)	(647)	(1,531.1)	(837)	(2,027)	(2.4290)
--	--	--	--	--	--	--
16,200	30,988	6,463	12,037.2	11,977	26,161	2.1846
267	213	226	135.6	215	163	.851955
634	380	165.8	39.8	314	134	.427933
1,413	1,257	2,558	2,455.6	1,541	1,461	.94822
2,314	1,850	2,949.8	2,631	2,070	1,758	.850058
8,545	8,289	6,545	5,146	7,007	6,919	.98747
9,820	11,221	3,469.83	2,060	8,677	9,611	1.10756
20,891	27,104	9,924	7,358	20,838	27,225	1.30647
24,962	37,763	20,158	16,924	18,778	24,925	1.32735
9,513	10,722	11,781	10,252	8,740	8,999	1.02965
4,800	6,000	2,550	1,275	2,806	3,072	1.09471
78,531	101,099	54,427	43,015	66,847	80,752	1.20799
57	48	--	--	33	25	.75449
101,184	137,473	64,559	58,322	85,916	112,319	1.3075

Land Area and Production of Dry Beans (Cowpe
in Senegal by Region and Department

Region and Department	1964-1965 Land Area (Ha)	1964-1965 Production (Tons)	1965-1966 Land Area (Ha)	1965-1966 Production (Tons)	1966-1967 Land Area (Ha)	1966-1967 Productior (Tons)
SINE-SALOUM						
Kaolack	23	7	25	7	30	10
Kaffrine	--	--	--	--	--	--
Gossas	900	270	900	270	525	171
Fatick	5,700	1,860	4,000	1,400	5,500	1,885
Foundiougne	350	140	350	140	300	120
Nioro	--	--	--	---	--	--
Region Total	6,973	2,277	5,275	1,817	6,355	2,186
THIES						
Thies	3,330	850	3,300	825	4,300	834
Tivaouane	5,000	1,850	5,200	1,820	5,500	1,365
M'Bour	1,960	580	2,000	600	2,300	690
Region Total	10,290	3,280	10,500	3,245	12,100	2,889
DIOURBEL						
Diourbel	500	150	440	132	550	82
Bambey	900	225	4,000	1,000	16,300	163
M'Backe	2,000	500	2,400	360	2,200	33
Kebemer	10,000	2,500	10,000	2,500	18,800	5,640
Louga	5,700	1,425	6,000	1,620	7,300	146
Linguere	1,000	250	1,000	200	1,300	195
Region Total	20,100	5,050	23,840	5,812	46,450	6,259
FLEUVE						
Dagana	4,500	1,935	4,500	1,000	5,351	2,337
Podor	11,000	3,300	5,300	530	1,119	322
Matam	2,269	594	2,200	770	12,041	3,421
Region Total	17,769	5,829	12,000	2,300	18,511	6,080
SENEGAL-ORIENTAL						
Tambacounda	800	230	800	240	845	245
Bakel	130	40	300	90	350	123
Kedougou	--	--	---	--	--	
Region Total	930	270	1,100	330	1,195	368
CASAMANCE						
Ziguinchor	--	--	--	--	272	80
Oussouye	52	18	400	120	619	185
Bignona	--	--	50	15	3	1
Sedhiou	--	--	--	--	--	--
Kolda	--	--	--	--	--	--
Velingara	--	--	--	--	--	--
Region Total	52	18	450	135	894	266
CAP-VERT						
Cap-Vert	240	100	300	105	382	140
National Total	56,354	16,824	53,465	13,744	85,885	18,188

1967-1968		1968-1969		Five-Year Average		
Land Area (Ha)	Production (Tons)	Land Area (Ha)	Production (Tons)	Land Area (Ha)	Production (Tons)	Yield Ton/Ha
110	30	185	54	75	22	.293
--	--	--	---	0	0	0.000
520	170	440	133	657	203	.309
6,200	1,860	6,100	1,830	5,500	1,767	.321
190	76	190	76	276	110	.398
--	--	--	--	0	0	0.000
7,020	2,136	6,915	2,093	6,508	2,102	.323
3,500	900	3,500	890	3,586	860	.240
5,600	2,470	6,000	1,138	5,460	1,729	.317
2,300	690	2,540	762	2,220	664	.299
11,400	4,060	12,000	2,790	11,266	3,253	.289
1,700	340	200	378	678	216	.319
19,000	3,600	6,150	1,100	9,270	1,218	.131
5,000	750	1,500	265	2,620	382	.146
15,000	3,000	15,000	4,500	13,760	3,628	.264
9,000	270	4,150	1,070	6,430	906	.141
1,300	195	1,200	180	1,160	204	.176
51,000	8,155	28,200	7,493	33,918	6,554	.193
9,453	9,588	6,003	781	5,961	3,128	.525
6,318	1,754	3,661	700	5,480	1,321	.548
11,322	3,762	8,378	2,543	7,242	2,218	.306
27,093	15,104	18,042	4,024	18,683	6,667	.357
883	265	1,014	304	868	257	.296
--	--	450	67	246	64	.260
161	48	--	--	32	10	.313
1,044	313	1,464	371	1,147	330	.288
334	119	300	105	181	61	.337
775	274	669	201	503	160	.318
18	7	159	61	46	17	.370
--	--	--	--	0	0	0.000
--	--	20	3	4	1	.250
--	--	--	--	0	0	0.000
1,127	400	1,148	370	734	238	.324
417	182	--	--	268	105	.392
99,101	30,350	67,808	17,131	72,524	19,249	.265

Land Area and Production of Corn
in Senegal by Region and Departme

Region and Department	1964-1965 Land Area (Ha)	1964-1965 Production (Tons)	1965-1966 Land Area (Ha)	1965-1966 Production (Tons)	1966-1967 Land Area (Ha)	1966-1967 Production (Tons)
SINE-SALOUM						
Kaolack	1,000	800	1,000	800	235	88
Kaffrine	800	640	600	480	280	136
Gossas	--	--	40	32	27	11
Fatick	--	--	70	50	19	7
Foundiougne	85	85	90	72	54	27
Nioro	480	408	300	240	138	69
Region Total	2,365	1,933	2,100	1,674	753	338
THIES (No data)						
DIOURBEL (No data)						
FLEUVE						
Dagana	500	225	500	225	315	157
Podor	3,500	1,225	5,000	750	2,896	1,643
Matam	10,500	6,646	10,500	6,825	11,271	6,558
Region Total	14,500	8,096	16,000	7,800	14,482	8,358
SENEGAL-ORIENTAL						
Tambacounda	3,500	2,700	3,800	3,515	3,980	3,471
Bakel	5,200	4,400	6,000	4,800	9,518	7,138
Kedougou	3,800	3,800	3,800	3,800	3,075	2,614
Region Total	12,500	10,900	13,600	12,115	16,573	13,223
CASAMANCE						
Ziguinchor	780	624	1,000	800	708	566
Oussouye	35	24	35	21	35	24
Bignona	1,750	1,517	1,750	1,487	1,392	1,196
Sedhiou	11,172	11,097	12,000	11,400	13,345	13,011
Kolda	2,291	1,832	2,800	2,240	4,443	3,775
Velingara	1,757	1,142	5,000	3,250	2,031	1,320
Region Total	17,785	16,236	22,585	19,198	21,954	19,892
CAP-VERT (No data)						
National Total	47,150	37,165	54,285	40,787	53,762	41,811

1967-1968		1968-1969		Five-Year Average		
Land Area (Ha)	Production (Tons)	Land Area (Ha)	Production (Tons)	Land Area (Ha)	Production (Tons)	Yield Tons/Ha
315	240	215	145	553	415	.750
370	277	225	155	455	338	.742
27	15	--	--	19	12	.617
55	39	7	3	30	20	.656
57	38	55	38	68	52	.762
340	272	355	249	326	248	.768
1,164	881	857	590	1,451	1,085	.748
452	127	--	--	353	147	.415
8,256	2,318	1,883	782	4,307	1,344	.312
10,798	6,659	5,067	2,967	9,627	5,931	.616
19,506	9,104	6,950	3,749	14,287	7,422	.519
4,087	3,679	2,735	1,367	3,620	2,946	.814
9,554	14,458	1,667.36	937	6,388	6,346	.994
3,690	3,136	2,440	2,074	3,361	3,085	.918
17,331	21,273	6,842	4,378	13,369	12,377	.926
724	589	207	165	684	549	.803
38	26	--	--	29	19	.664
1,789	1,454	1,491	1,192	1,634	1,369	.838
17,375	16,673	11,125	8,263	13,003	12,089	.930
5,698	6,070	4,713	4,068	3,989	3,597	.902
8,040	30,440	4,160	2,912	4,198	7,813	1.861
33,664	55,252	21,696	16,600	23,537	25,436	1.081
71,665	86,510	36,345	25,317	52,644	46,320	.880

Land Area and Production of Groundnuts (Peanuts) in Senegal by Region and Department

Region and Department	1964-1965 Land Area (Ha)	1964-1965 Production (Tons)	1965-1966 Land Area (Ha)	1965-1966 Production (Tons)	1966-1967 Land Area (Ha)	1966-1967 Production (Tons)
SINE-SALOUM						
Kaolack	63,639	63,381	64,645	64,645	71,695	74,240
Kaffrine	158,538	150,788	162,000	186,000	157,120	179,367
Gossas	83,309	76,170	83,000	83,000	91,320	73,792
Fatick	48,721	42,049	50,000	45,000	50,680	28,982
Foundiougne	46,651	41,338	46,000	46,000	45,280	45,215
Nioro	94,985	91,457	94,000	103,400	99,850	98,574
Region Total	495,843	468,183	499,645	528,045	515,945	500,170
THIES						
Thies	32,000	26,000	38,000	38,000	30,368	13,830
Tivaouane	68,000	55,000	68,000	64,600	69,000	54,211
M'Bour	37,000	41,000	40,000	40,000	21,700	17,360
Region Total	137,000	122,000	146,000	142,600	121,068	85,401
DIOURBEL						
Diourbel	48,000	46,000	39,000	43,000	42,000	15,558
Bambey	54,000	47,000	38,000	36,100	42,000	10,629
M'Backe	44,000	44,000	53,000	53,100	60,000	9,982
Kebemer	74,000	60,000	76,500	65,000	89,412	44,772
Louga	27,000	22,000	53,000	47,700	42,800	19,301
Linguere	19,000	21,000	24,500	19,600	31,051	14,748
Region Total	266,000	240,000	284,000	264,500	307,263	114,990
FLEUVE						
Dagana	14,000	6,000	16,000	9,600	10,980	7,832
Podor	1,000	200	1,000	300	--	--
Matam	270	120	10,000	6,000	152	63
Region Total	15,270	6,320	27,000	15,900	11,132	7,895
SENEGAL-ORIENTAL						
Tambacounda	25,500	25,500	25,000	27,500	25,229	24,917
Bakel	6,000	6,000	8,000	7,200	7,789	6,620
Kedougou	1,600	1,600	1,500	1,575	2,040	1,734
Region Total	33,100	33,100	34,500	36,275	35,058	33,271
CASAMANCE						
Ziguinchor	7,516	7,131	8,800	8,360	9,623	8,224
Oussouye	1,876	1,527	1,800	1,440	1,461	1,120
Bignona	30,850	31,785	30,000	31,500	32,653	19,771
Sedhiou	28,880	42,827	41,250	49,500	38,209	53,699
Kolda	19,403	23,647	21,000	25,200	27,541	32,904
Velingara	15,656	15,656	17,000	17,850	13,228	13,228
Region Total	104,181	122,573	119,850	133,850	122,625	128,946
CAP-VERT	4,186	1,860	4,000	2,400	3,578	1,965
National Total	1,055,580	994,036	1,114,995	1,123,570	1,116,669	872,638

[1]According to official sources used land area total for Casamance (1967-1968) has been overestimated by 15,835 ha production total by 30,857 tons. [2]According to official sources used land area total for Sine-Saloum (1968-1969) been overestimated by 5 to 8%. [3]For Thies by 4 to 5%. [4]For Diourbel by 5 to 10%. [5]Production for Diourbel has overestimated by 15%.

1967-1968		1968-1969		Five-Year Average		
Land Area (Ha)	Production (Tons)	Land Area (Ha)	Production (Tons)	Land Area (Ha)	Production (Tons)	Yield Ton/Ha
73,000	52,245	72,689[2]	53,447	69,134	61,592	.891
169,070	147,064	168,000	133,340	162,946	159,311	.978
91,950	64,158	89,650	54,958	87,846	70,416	.802
51,300	32,964	48,150	23,750	49,770	34,549	.694
46,780	70,867	47,000	41,037	46,342	49,491	1.068
--	--	99,200	74,310	77,607	73,548	.948
432,100	367,296	524,689	380,842	493,645	448,916	.909
44,788	41,200	46,096[3]	31,565	38,250	30,119	.787
74,790	74,290	86,000	59,925	73,158	61,605	.842
38,241	42,085	37,156	21,353	34,819	32,360	.929
157,819	157,575	169,252	112,843	146,227	124,084	.848
44,800	44,800	46,000[4]	27,620[5]	43,960	35,396	.805
48,000	43,200	44,000	26,970	45,200	32,780	.725
62,700	56,400	56,750	35,695	55,290	39,835	.720
64,400	64,000	87,249	57,965	78,312	58,347	.745
50,000	45,000	70,000	35,600	48,560	33,920	.698
31,500	23,850	35,000	21,620	28,210	20,164	.715
301,400	277,250	338,999	205,470	299,532	220,442	.736
12,188	6,765	12,000	1,500	13,033	6,339	.486
--	--	--	--	400	100	.250
160	72	--	--	2,117	1,251	.591
12,348	6,837	12,000	1,500	15,550	7,690	.495
25,751	25,751	24,368	24,480	25,170	25,630	1.018
8,377	8,377	6,322	3,319	7,298	6,303	.864
2,036	1,730	1,864	1,584	1,808	1,645	.910
36,164	35,858	32,554	29,383	34,276	33,578	.980
10,964[1]	8,271[1]	5,177	3,883	8,416	7,174	.852
1,461	1,169	946	1,135	1,509	1,278	.919
32,782	26,860	27,433	22,254	30,744	26,434	.860
43,683	60,082	41,661	36,838	38,737	48,589	1.254
29,905	35,885	23,149	24,531	24,182	28,433	1.176
18,540	20,390	16,420	16,420	16,169	16,709	1.033
137,335	152,657	114,786	105,061	119,755	128,617	1.074
5,115	3,282	2,836	713	3,943	2,044	.518
1,082,281	1,000,757	1,195,116	835,812	1,112,928	965,371	.855

APPENDIX D

Estimate of National Consumption

including Imports 1969-1973

(by tons)

	Years	1969	1970	1971	1972	1973
WHEAT	Imports	85,436	112,422	111,955	95,446	105,422
	Export flour (wheat equivalent)	16,597	28,822	6,742	231	12,226
	Total	68,839	83,578	105,253	95,215	93,196
	Consumption (2)	19.7	23.8	24.7	22.7	
MAIZE	Imports	41,263	5,014	32,848	10,365	51,453
	Production (1)	30,062	45,300	37,818	33,200	26,200
	Total	71,325	50,314	70,666	43,565	77,653
	Consumption (2)	15.37	14.95	13.8	14.35	
RICE	Imports (3)	224,687	183,624	288,765	261,653	295,629
	Production (1)	72,700	130,300	87,200	85,400	40,000
	Total	297,387	313,924	375,965	347,053	335,629
	Consumption (2)	77.24	85.29	87.46	80.85	
MILLET and SORGHUM	Imports	38,591	184	30,264	10,406	41,402
	Production (1)	486,400	566,300	436,400	507,500	410,900
	Total	524,991	566,484	466,664	517,906	452,302
	Consumption (2)	137.91	127.82	119.11	114.89	
TOTAL CEREALS	Import/Export	373,380	272,400	457,130	337,639	481,680
	Production (1)	589,162	741,900	561,418	626,100	477,100
	Total	962,542	1014,300	1018,548	1003,739	958,780
	Consumption	249.79	251.34	244.65	232.41	

(1) The local production which might be consumed per year 't' has been estimated to 9/12 of the campaign 't-1/t+ 3/12 of the campaign 'T/t+1' less the seeds necessary for the campaign 'T/t+1'.

(2) Consumption = Kg/person.

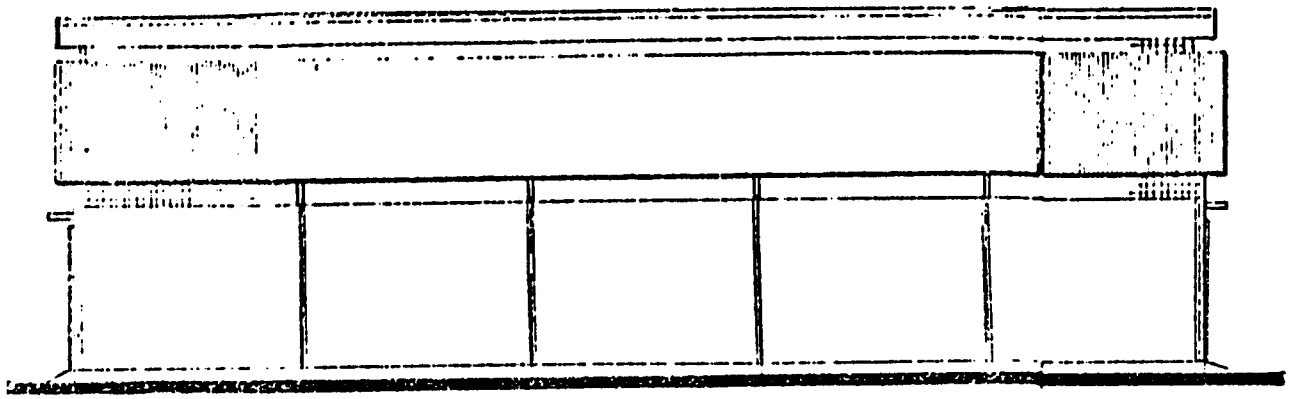
(3) Imports of white rice have been coverted in paddy rice (coefficient 1.54).

Sources: 1, "La Boulangerie Industrielle au Sénégal - Situation et Perspectives - " January 1975, Société Nationale d'Etudes et de Promotion Industrielle.

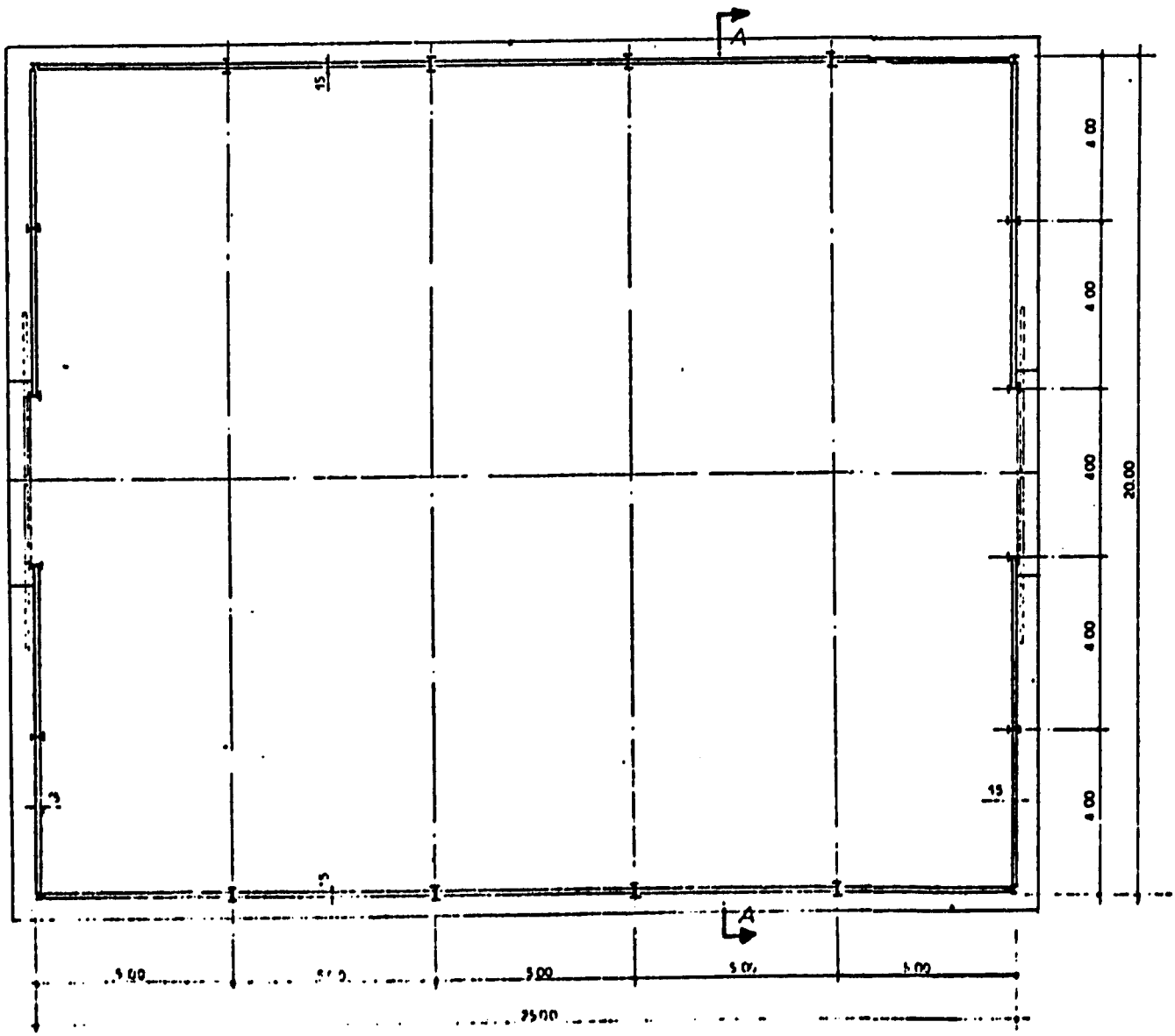
2. Projet d'Implantation d'une Minoterie de Mill - April 1974 Société Nationale d'Etudes et de Promotion Industrielle.

3. Projet de Synthèse du Travail du Groupe Loi-Programme de l'Alimentation du Sénégal - March 1974 - Groupe d'Etudes sur la Loi-Programme de l'Alimentation.

ELEVATION

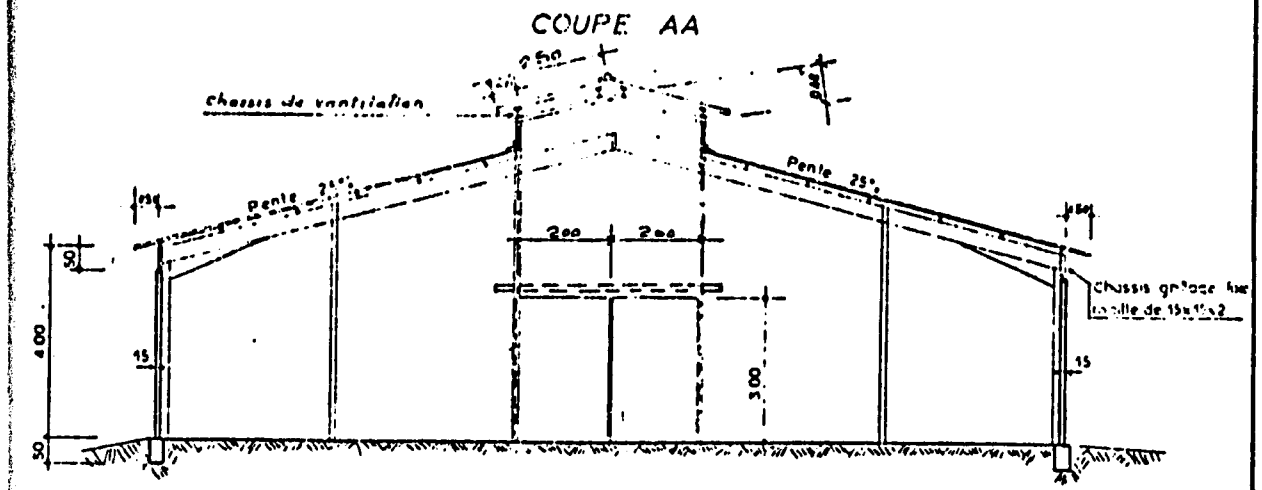


PLAN



NOTA
Les côtes indiquées sont brutes

APPENDIX E



REPUBLIQUE DU SENEGAL

OFFICE NATIONAL DE COOPERATION ET D ASSISTANCE POUR LE DEVELOPPEMENT

UNITE DE STOCKAGE

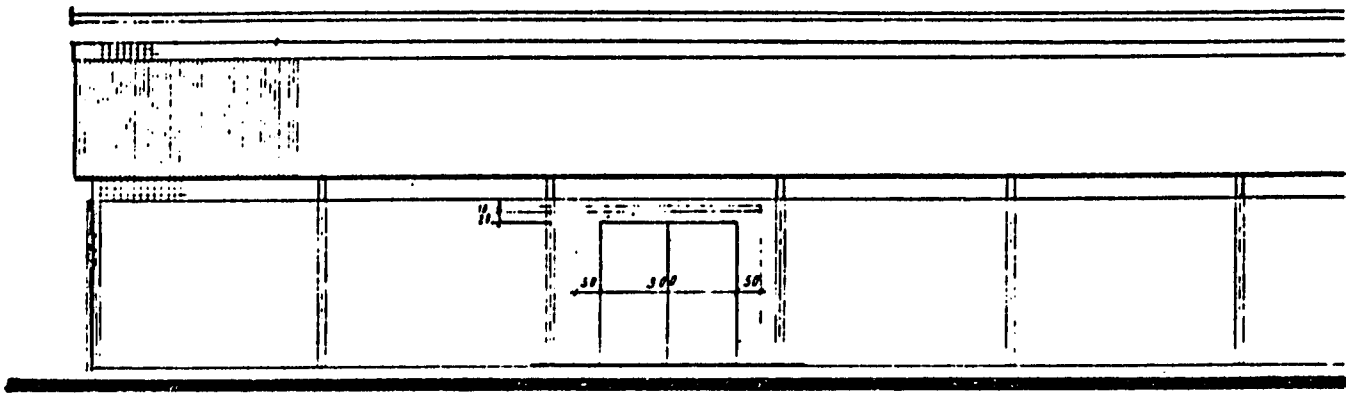
HANGAR DE 20,00 x 25,00

Capacité 1000t.

Ai modifié dimension poteaux et réduction intercaux le 12.6.75

ECHELLE 1/100°		DATE LE 13.02.1975
Dessiné par :	75.07	Vérifié par :

ELEVATION



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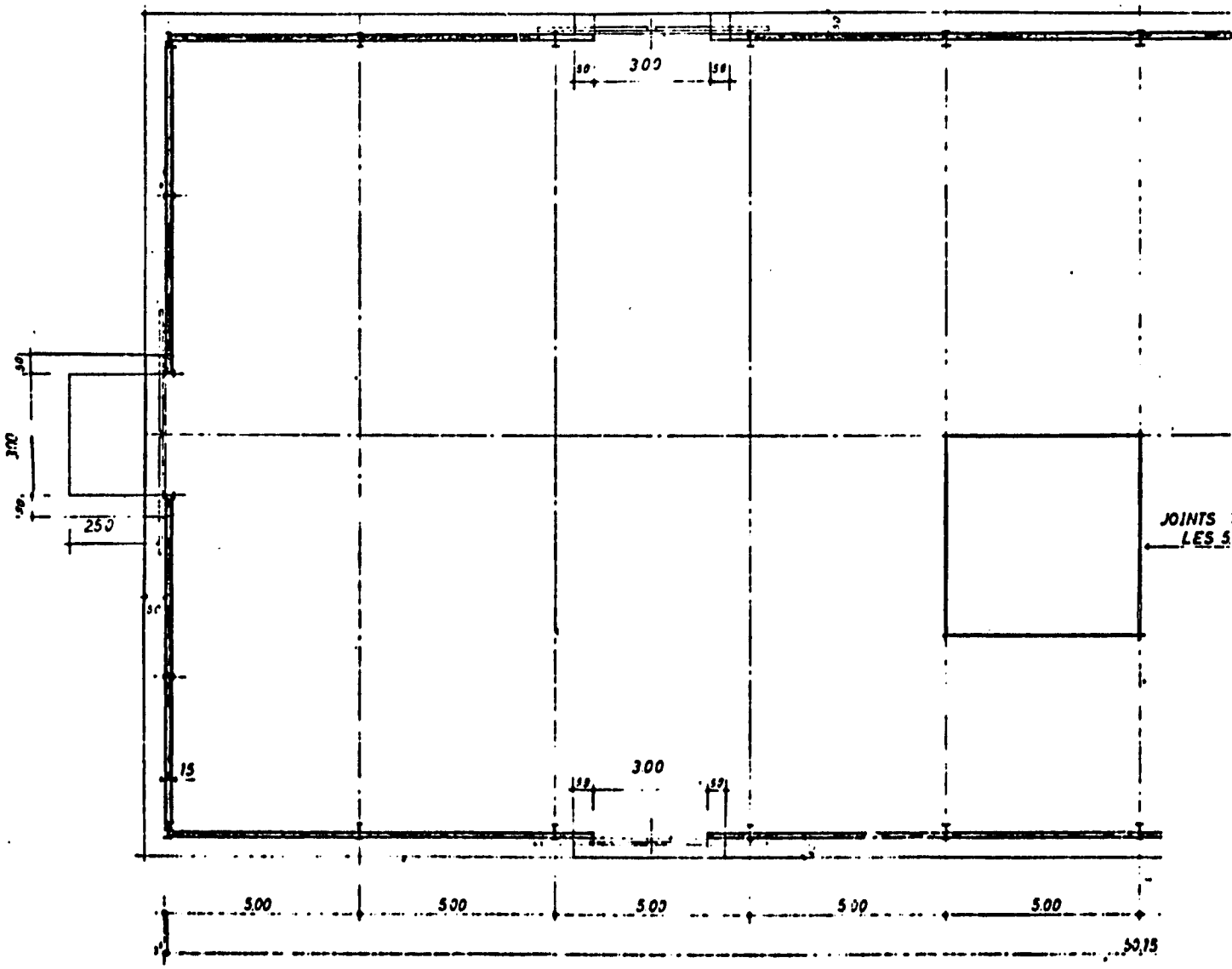
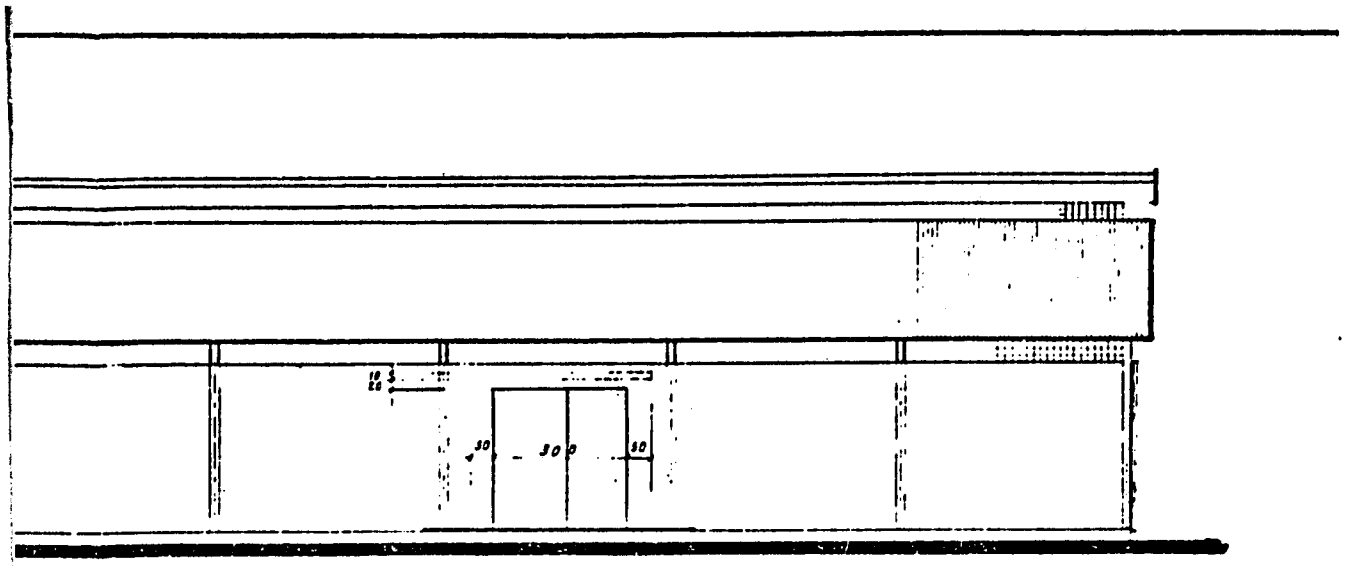
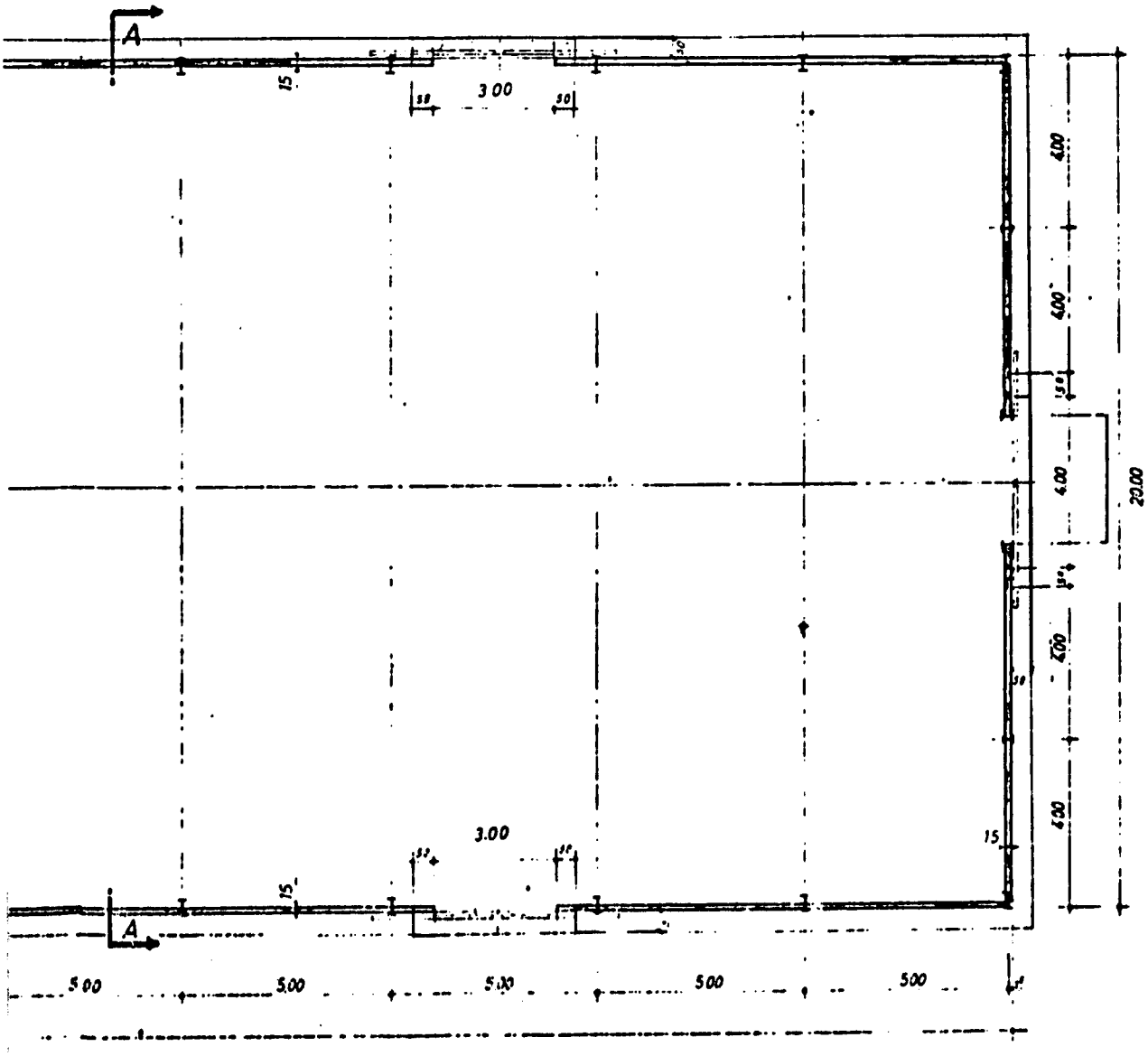
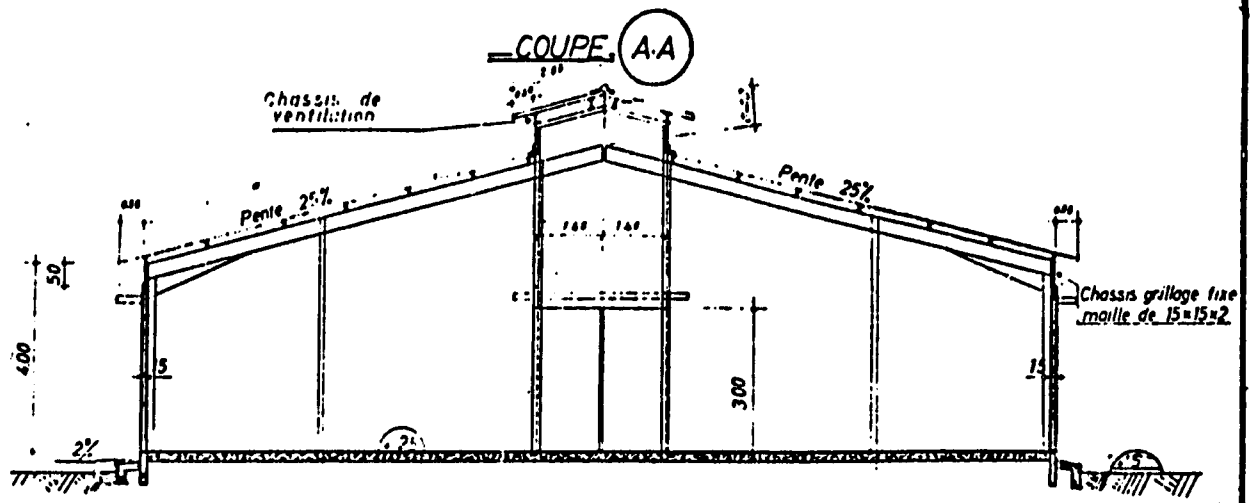






NOTA
Les cotes indiquées sont brutes

APPENDIX F



REPUBLIQUE DU SENEGAL

OFFICE NATIONAL DE COOPERATION & D'ASSISTANCE POUR LE DEVELOPPEMENT

UNITE DE STOCKAGE

HANGAR DE 20,00×50,00

Capacite 2000t.

ECHELLE 1/100		DATE LE 13.02.1975
Dessine par :	75.06	Vérifié par :

APPENDIX G

LIST OF WAREHOUSES BY ORDER OF PRIORITY OF COMPLETION

REGIONS	ORDER NUMBER	LOCALITY	CAPACITY T	REGIONS	ORDER NUMBER	LOCALITY	CAPACITY T
S/SALOUM	1	KAFFRINE +	2,000	DIOURBEL	23	KEBEMER +	2,000
DIOURBEL	2	DIOURBEL +	2,000	S/SALOUM	24	DJILOR +	1,000
FLEUVE	3	PODOR	2,000	THIES	25	FISSEL	1,000
DIOURBEL	4	LINGUERE +	2,000	S/ORIENTAL	26	KOUMPENTOUM	1,000
S/SALOUM	5	NIORO +	1,000	CASAMANCE	27	VEGINGARA	1,000
FLEUVE	6	DAGANA +	2,000	S/SALOUM	28	M.SABAKH +	1,000
S/SALOUM	7	GOSSAS +	2,000	DIOURBEL	29	D. MOUSTY	2,000
FLEUVE	8	MATAM +	1,000	THIES	30	TIVAOUANE	1,000
DIOURBEL	9	MBACKE +	2,000	S/SALOUM	31	FATICK +	2,000
S/SALOUM	10	OUAKH GOUNA +	1,000	FLEUVE	32	OUROSSOGUI +	2,000
DIOURBEL	11	BAMBEY +	2,000	S/SALOUM	33	SOKONE +	1,000
S/SALOUM	12	KOUNGEUL +	2,000	THIES	34	NIAKHENE	1,000
THIES	13	MBOUR	2,000	S/SALOUM	35	K.MADIABEL	1,000
THIES	14	JOAL	1,000	DIOURBEL	36	LOUGA	2,000
FLEUVE	15	AEREIAO	1,000	FLEUVE	37	THILLE BOUBA	1,000
CASAMANCE	16	SEDHIOU	1,000	S/SALOUM	38	KAOLACK	2,000
S/ORIENTAL	17	KEDOUGOU	1,000	THIES	39	THIES	2,000
S/SALOUM	18	COLOBANE +	2,000	S/SALOUM	40	FIMELA	1,000
DIOURBEL	19	DAHRA	2,000	THIES	41	THILMAKHA	1,000
FLEUVE	20	BAKEL	1,000	S/SALOUM	42	BIRKILANE	1,000
CASAMANCE	21	KOLDA	1,000	THIES	43	MEKHE	1,000
FLEUVE	22	DIOUM	1,000	S/SALOUM	44	NDOFFANE	1,000
CASAMANCE				THIES	45	NOTTO	1,000
				S/SALOUM	46	GANDIAYE	1,000
				THIES	47	THIADIAYE	1,000

+ To be completed in the first phase by the Government of Senegal.

COLUMBIAN [illegible] BUILDINGS

MASTER-CRAFTED BY COLUMBIAN SINCE 1893

BE SURE WITH **COLUMBIAN'S PROVEN QUALITY**

BAY SPACING: 20', 25' and 30'.

ROOF SLOPES: 1:12 and 4:12.

STANDARD DESIGN LOADS:

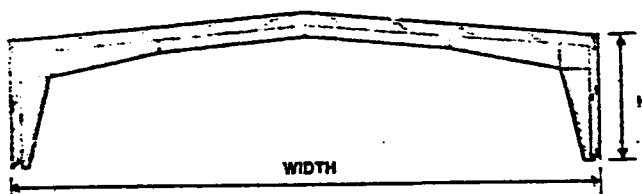
T-12 Design. (Tested for 12 Lb. Live Load.

CODE DESIGN BUILDINGS:

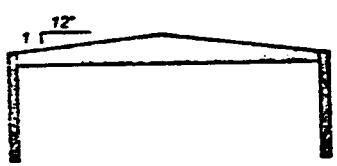
12 Lb. Live Load — 15 Lb. Wind Load
20 Lb. Live Load — 15 Lb. Wind Load
25 Lb. Live Load — 25 Lb. Wind Load
30 Lb. Live Load — 30 Lb. Wind Load

Special loadings on request.

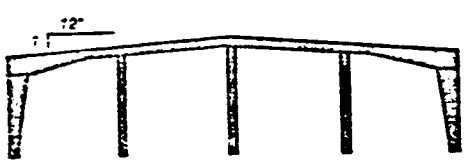
Wind Uplift or L. Class 60 and Class 80 are available on request.



WIDTHS	HEIGHTS
20'	10'
24'	12'
30'	14'
35'	15'
40'	20'
50'	
60'	
70'	
80'	
100'	



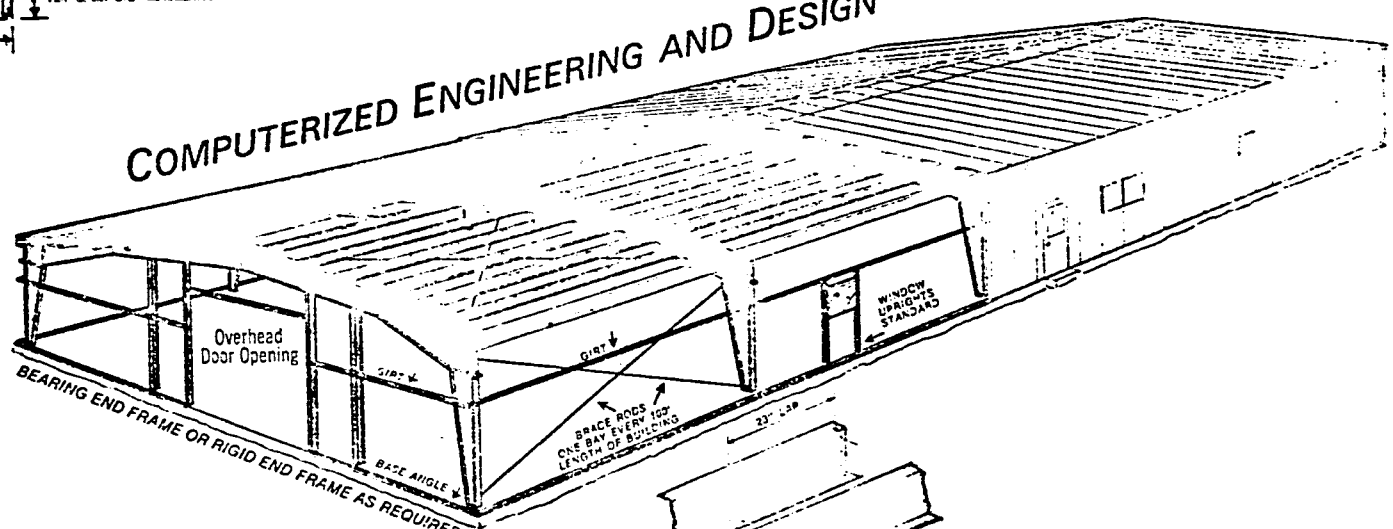
SLOPED BEAM DESIGN
(50' Maximum Width)

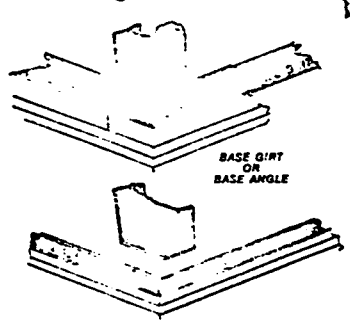


POST and BEAM DESIGN
(250' Maximum Width)

BOTH OF THESE DESIGNS ALSO AVAILABLE

COMPUTERIZED ENGINEERING AND DESIGN





ACCESSORIES AVAILABLE

Aluminum Sliding Windows	[illegible]
Personnel Doors	[illegible]
Plastic Skylights	[illegible]
Downspouts and Ridge Vents	[illegible]
Door Openings	[illegible]
Sliding Doors	[illegible]
Gutters and Downspouts	[illegible]

WEATHER DATA

The following weather data is from the ten major meterological stations in Senegal. The average temperature, average relative humidity and average rainfall data are 30 year averages. The average humidity data is the mean value of eight readings at three hour intervals. The other relative humidity and wind data are for the periods shown in the tables.

AVERAGE WEATHER DATA FOR DAKAR, SENEGAL (YOFF AIRPORT)

MONTH	AVERAGE TEMP. °C.	AVERAGE RELATIVE HUMIDITY PERCENT	AVERAGE RAINFALL MILLIMETERS	AVERAGE MINIMUM RELATIVE HUMIDITY 1951-1970, PERCENT	AVERAGE MINIMUM RELATIVE HUMIDITY 1951-1970, PERCENT	AVERAGE WIND VELOCITY AT 0600, 1200 & 1800 HOURS 1950-1970, MILES/HOUR	MAXIUM WIND VELOCITY 1961-1970, MILES/HOUR
JAN	21.1	69.0	0.4	49.0	90.5	14.1	55.9
FEB	20.4	80.0	1.6	55.5	93.0	14.1	53.7
MAR	20.9	78.0	0.0	58.0	93.5	15.2	38.0
APR	21.7	78.0	0.0	62.5	92.5	14.5	35.8
MAY	23.0	80.0	1.1	65.5	92.5	13.2	31.3
JUNE	26.0	77.0	9.4	64.5	89.5	11.4	55.9
JULY	27.3	78.0	90.5	65.0	88.0	10.5	69.3
AUG	27.3	78.0	223.9	67.5	90.5	9.8	89.5
SEPT	27.5	80.0	174.8	68.5	92.0	9.2	67.1
OCT	27.5	79.0	63.6	66.0	92.5	9.8	64.9
NOV	26.0	75.0	2.1	57.0	92.0	11.4	40.3
DEC	23.2	62.0	2.8	45.5	88.0	13.4	53.7

AVERAGE WEATHER DATA FOR DIOURBEL, SENEGAL

MONTH	AVERAGE TEMP. °C.	AVERAGE RELATIVE HUMIDITY PERCENT	AVERAGE RAINFALL MILLIMETERS	AVERAGE MINIMUM RELATIVE HUMIDITY 1951-1970 PERCENT	AVERAGE MAXIMUM RELATIVE HUMIDITY 1951-1970 PERCENT
JAN	23.7	36.0	0.1	18.5	69.0
FEB	24.8	39.0	1.3	16.5	68.5
MAR	27.4	38.0	0.1	15.0	72.5
APR	28.8	41.0	0.2	16.5	77.0
MAY	30.2	50.0	6.3	22.0	83.5
JUNE	30.4	66.0	40.2	33.5	88.5
JULY	28.6	62.0	139.5	50.0	92.5
AUG	27.7	79.0	259.8	58.5	95.5
SEPT	27.8	78.0	183.1	58.5	97.0
OCT	28.4	69.0	55.0	44.0	95.5
NOV	27.2	56.0	4.5	26.5	88.5
DEC	23.9	41.0	4.2	21.0	74.0

AVERAGE WEATHER DATA FOR KAOLACK, SENEGAL

MONTH	AVERAGE TEMP. °C.	AVERAGE RELATIVE HUMIDITY PERCENT	AVERAGE RAINFALL, MILLIMETERS	AVERAGE MINIMUM RELATIVE HUMIDITY 1951-1970, PERCENT	AVERAGE MAXIMUM RELATIVE HUMIDITY 1951-1970, PERCENT
JAN	24.8	33.0	0.5	16.5	59.5
FEB	26.5	37.0	0.9	16.0	62.5
MAR	28.5	34.0	0.0	13.5	65.0
APR	29.6	37.0	0.1	15.5	71.0
MAY	30.3	48.0	7.8	22.0	79.0
JUNE	30.0	61.0	61.1	37.0	86.5
JULY	28.7	75.0	160.2	53.5	92.5
AUG	27.6	80.0	295.1	62.0	96.0
SEPT	28.1	79.0	200.7	60.5	97.5
OCT	28.8	72.0	63.8	49.0	95.0
NOV	27.8	56.0	4.0	28.0	85.5
DEC	25.2	38.0	2.6	20.0	64.5

AVERAGE WEATHER DATA FOR KOLDA, SENEGAL

MONTH	AVERAGE TEMP. °C.	AVERAGE RELATIVE HUMIDITY PERCENT	AVERAGE RAINFALL, MILLIMETERS	AVERAGE MINIMUM RELATIVE HUMIDITY 1951-1970, PERCENT	AVERAGE MAXIMUM RELATIVE HUMIDITY 1951-1970, PERCENT
JAN	24.5	57.0	0.0	21.1	87.2
FEB	26.6	40.0	0.3	18.7	80.2
MAR	29.6	41.0	0.0	17.5	80.6
APR	30.7	41.0	0.0	20.2	78.8
MAY	31.2	51.0	19.6	28.5	81.0
JUNE	29.6	66.0	1052.8	47.5	91.0
JULY	27.3	79.0	255.7	61.5	96.5
AUG	27.0	82.0	398.6	68.0	97.0
SEPT	27.1	80.0	302.7	66.0	97.0
OCT	27.5	78.0	115.6	59.0	97.5
NOV	27.3	70.0	11.5	42.9	97.5
DEC	24.3	52.0	0.5	27.6	94.0

AVERAGE WEATHER DATA FOR PODOR, SENEGAL

MONTH	AVERAGE TEMP. °C.	AVERAGE RELATIVE HUMIDITY PER CENT	AVERAGE RAINFALL MILLIMETERS	AVERAGE MINIMUM RELATIVE HUMIDITY 1951-1970 PER CENT	AVERAGE MAXIMUM RELATIVE HUMIDITY 1951-1970 PER CENT
JAN	23.3	30.0	0.6	18.5	54.5
FEB	24.6	32.0	1.6	15.5	53.5
MAR	27.7	27.0	1.0	12.0	51.0
APRIL	30.5	25.0	0.1	10.5	52.5
MAY	32.3	31.0	3.2	13.0	57.5
JUNE	32.1	44.0	16.2	21.0	70.5
JULY	30.4	60.0	67.7	35.0	83.0
AUG	29.6	66.0	133.3	45.0	88.0
SEPT	29.6	68.0	83.8	47.5	89.5
OCT	29.9	59.0	23.2	38.0	78.5
NOV	28.2	48.0	3.0	28.5	70.0
DEC	23.1	37.0	2.0	23.0	60.0

AVERAGE WEATHER DATA FOR SAINT LOUIS, SENEGAL

MONTH	AVERAGE* TEMP. °C.	AVERAGE* RELATIVE HUMIDITY PER CENT	AVERAGE MINIMUM RELATIVE HUMIDITY 1951-1970 PER CENT	AVERAGE MAXIMUM RELATIVE HUMIDITY 1951-1970 PER CENT	AVERAGE WIND VELOCITY 1961-1970, MILES/HOUR	AVERAGE WIND VELOCITY 1961-1970. MILES/HOUR	AVERAGE RAINFALL MILLIMETERS
JAN	23.3	46.5	28.5	80.5	8.3	35.8	0.8
FEB	24.2	52.5	32.5	84.5	6.7	42.5	1.4
MAR	24.2	58.5	38.0	87.5	9.6	47.0	0.0
APRIL	25.2	52.5	46.5	90.0	9.4	38.0	0.2
MAY	24.6	66.5	57.5	92.5	10.5	35.8	1.3
JUNE	--	75.5	65.0	92.5	9.2	55.9	7.2
JULY	25.2	77.5	68.5	91.0	9.4	102.9	44.2
AUG	27.8	80.0	70.0	93.0	7.2	102.9	160.9
SEPT	28.6	79.5	67.5	94.5	8.5	114.1	96.7
OCT	28.4	70.0	55.5	92.5	7.4	69.3	28.5
NOV	26.3	57.5	38.5	88.5	7.4	31.3	2.4
DEC	24.2	47.0	30.0	82.0	7.2	33.6	3.3

*Average of two years, 1969 and 1974.

AVERAGE WEATHER DATA FOR LINGUERE, SENEGAL

MONTH	AVERAGE TEMP. °C.	AVERAGE RELATIVE HUMIDITY PERCENT	AVERAGE RAINFALL, MILLIMETERS	AVERAGE MINIMUM RELATIVE HUMIDITY 1951-1970 PERCENT	AVERAGE MAXIMUM RELATIVE HUMIDITY 1951-1970 PERCENT
JAN	23.8	27.0	0.1	15.5	49.5
FEB	25.2	31.0	1.5	16.0	52.0
MAR	27.8	29.0	1.6	15.5	55.0
APR	29.8	32.0	0.0	16.0	60.0
MAY	31.4	42.0	3.6	20.0	69.0
JUNE	30.9	54.0	81.8	29.0	81.0
JULY	28.8	69.0	100.7	45.5	89.5
AUG	27.7	76.0	209.0	55.5	94.5
SEPT	27.7	77.0	135.5	56.0	96.5
OCT	28.2	67.0	45.0	37.5	91.5
NOV	27.2	47.0	4.3	23.5	73.0
DEC	23.9	33.0	2.0	19.5	57.5

AVERAGE WEATHER DATA FOR MATAM, SENEGAL

MONTH	AVERAGE TEMP. °C.	AVERAGE RELATIVE HUMIDITY PERCENT	AVERAGE RAINFALL, MILLIMETERS	AVERAGE MINIMUM RELATIVE HUMIDITY 1951-1970 PERCENT	AVERAGE MAXIMUM RELATIVE HUMIDITY 1951-1970 PERCENT
JAN	23.3	34.0	0.9	17.0	65.5
FEB	25.0	35.0	0.8	15.5	62.0
MAR	28.8	29.0	0.3	13.0	55.0
APR	31.4	27.0	0.1	14.5	49.5
MAY	33.8	31.0	4.0	16.0	50.5
JUNE	32.5	36.0	50.4	25.5	65.5
JULY	29.4	65.0	128.8	42.0	84.5
AUG	28.0	72.0	202.3	54.0	92.0
SEPT	28.3	70.0	122.0	53.5	92.5
OCT	29.3	61.0	22.4	39.0	88.0
NOV	27.4	50.0	2.4	23.5	80.5
DEC	23.5	40.0	2.3	20.0	69.5

AVERAGE WEATHER DATA FOR TAMBACOUNDA, SENEGAL

MONTH	AVERAGE TEMP. °C.	AVERAGE RELATIVE HUMIDITY PER CENT	AVERAGE MINIMUM RELATIVE HUMIDITY 1951-1970 PER CENT	AVERAGE MAXIMUM RELATIVE HUMIDITY 1951-1970 PER CENT	AVERAGE WIND VELOCITY 1961-1970, MILES/HOUR	AVERAGE WIND VELOCITY 1961-1970, MILES/HOUR	AVERAGE RAINFALL MILLIMETERS
JAN	24.5	28.0	12.0	56.5	4.5	24.6	0.1
FEB	26.5	25.0	11.5	51.5	3.4	44.7	0.6
MAR	30.0	25.0	10.5	49.0	7.6	24.6	0.1
APRIL	31.4	29.0	13.0	53.5	6.0	71.6	2.1
MAY	32.4	40.0	21.0	62.5	7.2	69.3	19.9
JUNE	29.8	59.0	39.5	83.0	6.9	58.2	130.9
JULY	26.7	78.0	58.5	95.5	4.7	53.7	196.2
AUG	26.4	81.0	64.5	97.5	4.7	64.9	288.8
SEPT	26.0	82.0	62.5	98.5	4.7	62.6	231.2
OCT	27.2	76.0	50.5	97.5	4.0	49.2	70.0
NOV	26.9	60.0	27.0	92.0	3.1	26.8	2.3
DEC	24.1	37.0	16.0	69.5	5.4	31.3	0.1

AVERAGE WEATHER DATA FOR ZIGUINCHOR, SENEGAL

MONTH	AVERAGE TEMP. °C.	AVERAGE RELATIVE HUMIDITY PER CENT	AVERAGE MINIMUM RELATIVE HUMIDITY 1951-1970 PER CENT	AVERAGE MAXIMUM RELATIVE HUMIDITY 1951-1970 PER CENT	AVERAGE WIND VELOCITY 1961-1970 MILES/HOUR	AVERAGE WIND VELOCITY 1961-1970 MILES/HOUR	AVERAGE RAINFALL MILLIMETERS
JAN	24.0	45.0	30.0	89.0	4.5	31.3	0.1
FEB	25.7	55.0	27.0	88.6	5.4	31.3	0.9
MAR	27.3	57.0	24.5	90.0	6.3	33.6	0.0
APRIL	28.0	61.0	28.0	90.5	6.3	42.5	0.1
MAY	28.5	66.0	39.5	92.5	6.5	33.6	9.7
JUNE	28.4	75.0	51.0	94.0	7.4	60.4	125.1
JULY	27.0	84.0	65.5	97.5	5.1	67.1	362.8
AUG	26.4	87.0	70.0	98.5	4.2	60.4	532.4
SEPT	27.0	85.0	67.0	98.5	4.0	55.9	361.0
OCT	27.8	82.0	60.0	98.0	3.6	62.6	146.0
NOV	27.0	75.0	47.0	97.0	3.6	29.1	8.1
DEC	24.5	61.0	35.0	92.0	4.5	29.1	0.9

ESTIMATED COST OF GRAIN GRADING EQUIPMENT

Equipment for 47 warehouses:

Moisture Testers, 47 at	$1500		$70,500
Triers, ½" x 30", 47 at	40		1,880
Thermometer, 47 at	35		1,645
Hygrometer, 47 at	40		1,880
		Subtotal	$75,905

Equipment for 600 Buying Stations

Moisture Testers, 600 at	$250		$150,000
Triers, ½" x 30", 600 at	$40		24,000
Sieves, 600 sets at	$80		48,000
		Subtotal	$222,000

Total estimated cost of equipment
for 47 warehouses and 600 buying stations $297,905

ONCAD SECCO Storage for Peanut Seeds

Sine Saloum Region 1974/75

DISTRICT	No. of WHSES[1/]	VOLUME (cubic meters)	CAPACITY[2/] (metric tons)
GOSSAS	18	24,578	7,991
KAFFRINE	41	54,525	15,790
FATICK	25	23,972	7,790
NIORO	17	21,316	6,932
FOUDIOUGNE	14	18,570	6,034
KAOLACK	22	29,817	9,688
TOTAL	137	172,778	54,225

1/ Type of construction not indicated.

2/ Capacity is based on bulk storage of groundnut. When stored in sacks the capacity is reduced by 20%.

Source: ONCAD, Nov., 1975.

ONCAD SECCO Storage for Peanut Seeds

Diourbel Region 1974/75

DISTRICT	No. of WHSES[1/]	VOLUME (cubic meters)	CAPACITY[2/] (metric tons)
BAMBEY	16	20,488	6,656
DIOURBEL	13	15,336	4,990
KEBEMER	15	25,220	8,197
LINGUERE	13	9,100	2,962
LOUGA	14	11,376	3,697
M'BACKE	18	23,908	7,768
TOTAL	89	105,428	34,270

1/ All warehouses are of metal construction.

2/ Capacity is based on storage of groundnut in bulk. When stored in sacks the capacity is reduced by 20%.

Source: ONCAD, Nov., 1975.

ONCAD SECCO Storage for Peanut Seed

Thies Region 1974/75

DISTRICT	No. of WHSES[1/]	VOLUME (cubic meters)	CAPACITY[2/] (metric tons)
M'BOUR	16	17,560	5,709
THIES	14	14,400	4,678
TIVAOUANE	18	21,820	7,049
TOTALS	48	53,780	17,434

1/ No indication of type of construction.

2/ Capacity is based on bulk storage of groundnut. When stored in sacks the capacity is reduced by 20%.

Source: ONCAD, Nov., 1975.

ONCAD SECCO Storage for Peanut Seeds

Casamance Region 1974/75

DISTRICT	No. of WHSES[1/]	VOLUME (cubic meters)	CAPACITY[1/] (metric tons)
BIGNONA	10	6,181	2,007
ZIGUINCHOR	2	392	126
OUSSONYE	2	1,050	341
VELINGARA	16	6,229	2,018
SEDHIOU I	22	6,537	2,113
SEDHIOU II	18	6,850	2,221
KOLDA	27	17,876	5,809
TOTALS	97	45,115	14,635

1/ All warehouses of metal construction.

2/ Capacity is based on bulk storage of groundnut. When stored in sacks the capacity is reduced by 20%.

Source: ONCAD, Nov., 1975

ONCAD SECCO Storage for Peanut Seeds

Senegal Oriental Region 1974/75

DISTRICT	No. of WHSES	VOLUME (cubic meters)	CAPACITY[3/] (metric tons)
TAMBACOUNDA	15[1/]	12,452	4,047
	1[2/]	150	50
	16	12,602	4,097
BAKEL	6[1/]	3,836	1,248
	3[2/]	636	210
	9	4,472	1,458
KEDOUGOU	1[1/]	760	247
	5[2/]	750	250
	6	1,510	497
TOTAL	31	18,584	6,052

1/ Warehouses of metal construction.

2/ Warehouses of masonry construction.

3/ Capacity is based on bulk storage of groundnut. When stored in sacks the capacity is reduced by 20%.

Source: ONCAD, Nov., 1975.

ONCAD Grain Storage Centers

REGIONS	LOCATION	CAPACITY (in metric tons)
CASAMANCE	BIGNONA	10,000
	KOLDA I	8,000
	KOLDA II	8,000
	VELINGARA	10,000
	DIANNAH I	5,000
	DIANNAH II	5,000
	Subtotal	46,000
DIOURBEL	BAMBEY I	10,000
	BAMBEY II	10,000
	MBACKE I	10,000
	MBACKE II	10,000
	DAROU MOUSTY	10,000
	KEBEMER	10,000
	LOUGA	10,000
	DARAH	10,000
	Subtotal	80,000
SENEGAL ORIENTAL	TAMBACOUNDA	10,000
	KOUSSANAR	8,000
	Subtotal	18,000
SINE SALOUM	KAFFRINE	20,000
	GOSSAS	8,000
	BUINGUINEO	10,000
	NIORA DU RIP	10,000
	KEUR MADIABEL	10,000
	FATICK	10,000
	Subtotal	68,000
THIES	BASE AERIENNE (Air Base)	30,000
	Subtotal	30,000
	TOTAL CENTRAL STORAGE	242,000 m.t.

Source: ONCAD, 24 November 1975.

RECOMMENDATION
FOOD FOR PEACE COMMODITY STORAGE

A "Seminar in Food Storage and Handling Practices" was held in Dakar, Senegal November 4-8, 1974. The Seminar was co-sponsored by the Office of Food For Peace and the Office of Nutrition with the Office of Agriculture, TAB, Agency for International Development. Even though the Seminar outlined and demonstrated good storage management and practices there are a variety of problems in setting these practices in motion.

It was obvious from inspecting the small quantity of grain sorghum stored in Dakar for shipment to Mauritania that steps must be taken by persons responsible for the commodities to see that proper storage and maintenance is provided.

The following general suggestions are offered as a means of providing the proper storage and maintenance of Food For Peace commodities.

- Secure sound storage facilities. This may not always be possible, however, attempts should be made to obtain the best storage facilities available. If facilities are leased, it should be stated in the lease agreement that the facilities should meet certain basic criteria, i.e. have roofs that do not leak, have doors and/or windows that are adequately protected against entrance by rodents and birds. In cases where covered storage (warehouse structures) is not available, provision should be made to protect the commodity from the elements.

- Use proper storage practices. Commodities should be stored off the ground or warehouse floor on pallets (or dunnage) or otherwise protected from water or condensation from the storage surface. Where only earthen or other non-raised storage surfaces are available, pallets or dunnage should be used. In warehouses with raised storage floors where it is

obvious flooding will not occur, water-proof tarps will help to prevent condensation from occurring.

Commodities should be stocked so that they may be readily inventoried and inspected regularly. There are any number of stocking patterns that may be used for this purpose.

- Inspect commodities regularly and provide for fumigation when necessary. Too often commodities are received for distribution and no provision made for routine maintenance of the commodity. Under conditions existing in the developing countries, cereal commodities should be inspected every 2 weeks. In no case should inspections be less frequent than monthly. Meaningful inspections require that persons making the inspection be qualified to determine the presence of problem conditions, i.e. insects, molds, high moisture, rodents, etc. When deterioration of the commodity from any of the several causes is detected, action should be taken immediately to correct the situation. This will generally require the procurement of professional services of one type or another. Provision must be made by Food For Peace to have these services available when needed.

In the case of rodents, a central program should be initiated at the time the commodities are stored.

GRAIN STORAGE AND MARKETING SHORT COURSE

The following outline is a guide to the material covered during the Kansas State University A.I.D. Grain Storage and Marketing Short Course. Lecture and laboratory outlines are prepared in English-French-Spanish. Instruction is in English with simultaneous French and Spanish translation. The course is 8-weeks long with 1-week orientation in Washington, D.C., 5 weeks intensive lecture, laboratory field trip training on the KSU Campus, and 2 weeks tour in rice area and port facilities.

Grain Storage and Marketing Short Course Outline

I. Introduction to Course.

   A. Importance of Grain Storage and Marketing.
   B. Purpose and Scope of Course.

      1. Provide basic fundamentals of Grain Storage and Marketing.
      2. Provide practical knowledge and techniques needed in Grain Storage and Marketing.

II. Review of Grain Production, Storage, Marketing and Utilization in Participant's Countries.

III. Fundamentals of Grain Storage.

   A. Grain kernel structure.
   B. Moisture and its measurement.
   C. Mold: moisture relationships.
   D. Chemical, physical, and nutritive changes during storage.

IV. Grain Inspection - Standard, Sampling, and Grading.

V. Grain Handling:

   A. Movement of grain.
   B. Methods and facilities for conditioning grain.
   C. Aeration - cooling of grain.
   D. Grain drying - principles, types of drying, types of driers, and drier operation.
   E. Equipment maintenance.

VI. Storage

   A. Storage methods and procedures.
   B. Types of structures - farm, warehouse, and elevator storage.
   C. Structural maintenance.

VII. Sanitation Program

   A. Inspection - methods and equipment.
   B. Housekeeping - storage sites, structures and equipment.
   C. Insect control - biology and identification; physical, mechanical, and chemical methods; pesticide safety.

VIII. Economics of Marketing Management and Operations.

A. Principles of management.
B. Principles of operation.
C. Organization of the grain business - business, financial, operational structures, and facilities planning.
D. Facilitating grain operations - public warehousing, financing and rise, crop forecasting, price reporting, standardization, and price differentials.
E. Bookkeeping, accounting and inventory control.
F. Government and marketing.

IX. Field Trips to Demonstrate Classroom Instruction.

X. Laboratory Work Sessions to Complement Lectures.

A. Grain inspection.
B. Moisture determination.
C. Effects of grain drying and aeration.
D. Insect identification.
E. Demonstration of pest control methods.
F. Business procedures and marketing analysis methods.
G. Records keeping for warehouses and elevators.
H. Assessment of grain storage and marketing economy.