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PRELIMINARY NOTE

The present document follows a meeting of the C.I.L.S.S. select working committee on marketing, storage and price problems, held in PARIS on 8th. September 1978 to discuss the initial report on cereal storage.

During this meeting, certain criticisms and remarks were expressed and it became clear that it was essential to draw up a synthesis which would not be confined to the matters dealt with in the report.

As a matter of fact, as some delegates pointed out, storage is only a part of a whole from which it cannot be separated.

And so this synthesis has been compiled in the hope of satisfying this requirement. It will be noted that we have ventured to widen the scope of the debate by considering a strategy that goes well beyond the mere field of cereal storage.

INTRODUCTION

In the field of general economy, especially as regards food economics, cereal storage plays an essential part in the marketing and the distribution chain. Indeed, it makes it possible to supply markets regularly in space and time, that is to say to adapt supply to demand, thus often enabling prices to be stabilized.

But, if the whole economic process from production to consumption is considered, you can say that storage is merely a link in a chain or just one single part of the system often called : "Production - Marketing - Storage - Transformation - Distribution" (1).

It is for this reason that, at the end of this vast study, which should result in practical recommendations and proposals for a clearly-defined strategy, it seems essential to replace the cereal storage question within its ecological and sociological context and to consider its organization within the broader framework of long-term agricultural and food policy.

(1) See "L'économie des produits vivriers au SAHEL" par M. LABONNE, F. LAURET et J.C. MONTIGAUD - INRA-Economics, ENSA Montpellier, 1977.

I - GENERAL SURVEY

1. STORAGE : TECHNICAL PROCESSES AND STRUCTURES

When you travel through the various districts in the SAHEL, the first thing that strikes you concerning cereal storage is the large number of granaries in rural areas and the lack of such installations, as regards quality rather than quantity, in urban areas.

Country granaries

Grain storage in rural areas is a very old practice linked to the time when peasants settled in one given place, and one that enjoys well-tested experience. The technical processes used for making these granaries -materials, shapes, dimensions and lay-out- reveal a considerable capacity making use of local resources and an architectural design that is both aesthetic and efficient.

The capacity of these granaries also show that volumes and weights have been accurately estimated. Thus, the granary built in "secco" -braided vegetable fibres- comprise double the volume of those built in "banco" -pugged earth- to contain the same quantity of millet or sorghum ; in the first case, it is a question of ears of grain, whereas in the second of threshed grain, as the granary built in "banco" is stronger and more hermetic. On the other hand, the capacity of country granaries corresponds to the minimum requirements of members of a family, i.e. about 200 kg of grain per person.

In the event of a surplus crop, if a new granary is built with local materials that cost nothing, it will be possible to store the grain in the village, instead of selling it hurriedly often at a low price.

Public warehouses and private storehouses

It was more especially during and after the great drought in the years 1972-1974 that public authorities started to study the question of supplying their country with new means of storage. The areas equipped in priority were the rural regions that had suffered most from the drought, and above all urban centres.

These warehouses usually consist of big metal sheds with cement floors and walls composed of blocks or metal sheeting. Sometimes, they are fairly low shelters made of all-metal prefabricated parts, or sometimes big round plastic tanks (butyl, etc.), supported all round by a rigid wall and with a done-shaped canvas cover. The latter two types of silo are very hermetic, but they are somewhat inconvenient as regards handling ; they are often kept for storing stand-by and emergency stocks.

The design of these different storage buildings is not always suitable for the particular conditions prevailing in tropical regions. The confined atmosphere (inert gas) enables the grain to be kept in a heathly state at little cost, but the grain must be completely dry, which is not always the case in damper regions. On the contrary, whereas the natural ventilation, in classic-type shelters for example, helps the grain to dry, it reduces the efficacity of anti-parasite-treatments, as it is difficult to close the various apertures hermetically.

Whereas bulk storage presents great advantages, bags often have to be used for handling and transport reasons : the labour available is abundant, quantities are often small and mechanical means are costly. But it must not be forgotten that bags are also expensive and somewhat fragile. It therefore becomes a matter of cost price and accounting.

Management problems are extremely delicate and often leave a lot to be desired. The reason for this lies essentially in the public storage structure. Various States have set up cereals boards directly under their control and these boards are responsible for collecting, storing and marketing the cereals. Unfortunately, the means available make it difficult to achieve targets : insufficient credits, transport means and sometimes storage ; the long time required for obtaining decisions and information, slow communications. This often means that the boards abandon their initial target and their market-regulating role and devote themselves essentially to the management and distribution of food aids. For their part, the producers become discouraged and turn to the private merchants, whose function appears all the more important as it had been disregarded for so long.

Sectors and systems adverse ?

This experiment may be salutary and provide an opportunity to underline the danger of the traditional opposition between "public" and "private", likewise between "modern" and "traditional". There can be no question of contesting the right of States to control their populations' regular supplies of essential goods at reasonable prices and to ensure that sufficient reserves are available in the event of famine or in an emergency. This latter point is capital in the SAHEL region, and it is easy to understand why public authorities want to maintain control of the organization of emergency storage.

But in so far as marketing and transporting current stocks are concerned, it is almost impossible for a government body to have the flexibility required to take the following into account : the variation in the flow of merchandise, the fact that homes are scattered over a wide area, the diversity in social situations and the distances to be covered, not to mention the state of the roads. This is why it seems advisable to try to find solutions using both "public" and "private" enterprise in a complementary manner. The former is better placed for the purpose of providing information and for organizing the transport of merchandise on a national and regional scale, whereas the latter can play the same role very efficiently at more local level, thanks to its exceptionnal and inexpensive network of relations. In order to avoid abuses, especially between crops and in periods of penury, the executives on the boards should watch the movement of prices on the market and be allowed sufficient initiative to intervene in the trading circuit with the stock for which they are responsible.

This pre-supposes that the principal urban centres or the main market centres are equipped with storage capacity and that the staff of these boards has been given sufficient responsibility and been trained accordingly. This training, so useful for accountancy management and preserving stocks, could be offered by the State to any persons requiring it, whether producers or merchants, including any of them who wanted to get together and organize a co-operative.

In this way, far from cutting itself off from traditional and private sphere -peasants and merchants- by opposing it to the modern public world- -townsmen and civil servants-, the State would ensure the nation's progress and really fulfil its public service task.

2. AGRO-CLIMATOLOGY AND STORAGE

Since storage is merely a link in the overall food supply system, it must not be separated from the whole and especially not from the basic elements, which are "upstream production" and "downstream consumption". Now these two factors depend on their geographical and human situation to an enormous extent. This is why the cereal storage question must be studied in conjunction with the agro-climatic characteristics of the SAHEL countries and with some aspects of their demographic and sociological evolution.

It is customary to divide the SAHEL up climatologically into irregular horizontal strips depending on the isohyets, that is to say curves illustrating the average amount of annual rainfall (1). And so, the SAHEL is said to cover an area between 200-300 and 700-800 mm. This geographical region represents essentially the SAHEL climate, that is to say a long dry season without any rain for from 8 to 9 months, and a rainy season during the winter lasting from 3 to 4 months.

However, these climatic limits are not clearly defined and can vary from one year to another. This is why two or three regions of the SAHEL type can usually be distinguished, i.e., from North to South : the Sahara-Sahel region (between isohyets 200 and 400 mm), the Sahel region and the Sahel-Sudan region (between 800 and 1000 mm).

These regions also enable the "Sahel countries" to be classified according to the size of their surface area compared with the rest of the national territories. And so, Mauretania and Niger, the countries extending deepest into the Sahara, are called "Sahara-Sahel" ; on the other hand, Senegal and the Upper Volta are labelled "Sudan-Sahel", and, between the two, Mali and Chad are marked by the three types of climatic conditions. Two other members of the C.I.L.S.S., Cambia and the Cape Verde Islands must be added to these six countries, but they are so particular that they must be considered separately.

(1) It is perhaps interesting to recall the meaning of the word "SAHEL". It comes from Arabic and the word means "edge, shore, coastal region". Traditionally, it was applied to the hills on the coast along the Mediterranean shore, and, by analogy, it became applied to the Southern edge of the Sahara desert, at the risk of confusion and m[illegible]ing essential differences : a continental "shore" and not a maritime on[illegible] an arid zone and not a fertile one.

Soil fertility naturally depends on these climatic conditions. A mere glance at the map of the SAHEL regions (1) shows that only the Southern part of these countries benefits from a higher rainfall, and this in a very unequal manner. The Upper Volta and Senegal enjoy the Sudan climate on a large proportion of their territory, and Gambia even more, which is entirely in the Sudan region. Thus, agriculture is prosperous and there are often surplus crops.

Mali and Chad are already less favoured, although their Sudan edge is not negligeable. As for Mauretania and Niger, they are entirely subject to the Sahel climate, where the soil's semi-aridity and evaporation make agriculture precarious.

Traditionally, the fallow rule allowed the soil to rest and resist erosion by wind and rain. Likewise, animal migration in the most arid areas, and the fact that the pastoral people are semi-nomadic, made it possible to preserve pasture lands. But, little by little, the region of fragile lands protected by the fallow system became smaller, and stock rearing became more intensified owing to demographic pressure and economic necessity, not to mention the concentration of men and animals that occurred during the great drought in the recent years.

The result is that the soil often becomes completely exhausted. This is further aggraved by greater vulnerability to over-pasturing and erosion risks, and a fall in agricultural productivity may occur.

In view of this, great efforts are being made to use water resources to maximum advantage. Surface networks come to mind first. Some countries are favoured in this respect and they are often the same as those favoured by climatic conditions : Senegal and Gambia, on the one hand ; Mali, Upper Volta and Chad, on the other. Major works in the main valleys have either been decided on, or are already being undertaken ; these works should help Mauretania and Niger to increase their agricultural potential thanks to irrigation.

(1) See the agro-climatic map in the Appendix. In this connection, it is also useful to mention the importance of meteorological information and the research work carried out in this field. At least, attention should be called to an agro-meteorological program and a permanent observation system at present being set up in the Sahel region of Africa.

Furthermore, it is said that the reserves of underground water supplies are bigger than was once thought, even in the desert ; the same applies to the Cape Verde Islands, where rainfall has been almost insignificant for more than ten years. The problem of making good use of these water supplies is more particularly a matter of power, and great reliance is now being placed on solar energy, the use of which has already proved very positive.

But, when the various countries in the Sahel are compared and their respective chances assessed, it becomes obvious that some other distinction must be made and one which marks them deeply, namely the distinction between inland and coastal areas. This is a geographical distinction and not a climatic one, a vertical one rather than a horizontal one, which has a considerable influence on the evolution and development of these countries and on their capacity to defend themselves -and to store- in the event of an agricultural calamity.

The four inland countries : Mali, Upper Volta, Niger and Chad, are totally dependent on neighbouring countries for their relations with the non-African world and even with part of the African continent. Whereas Mali and Upper Volta have railways linking them to the sea, and good roads to the South coast, Niger, and even more Chad, remain entirely hemmed in ; especially as a large part of their territory extends Northwards, in the opposite direction to the main trade and communication routes leading to the South coast and the outside world.

This is mainly due to the physical obstacle represented by the Sahara, although modern roads are increasingly improving the traditional links with the Northern part of the continent.

In this connection, the countries with a coastline can establish exchanges with the outside world without difficulty. Senegal, which enjoys the advantage of the big port of Dakar, has developed a good road network in addition to its railways and waterways. Gambia has no problems with supplies for inland areas thanks to its navigable river. Mauretania is busy developing its port installations, and especially carrying on the development of the main road NOUAKCHOTT-NEMA.

As for the Cape Verde Islands, their excellent air and sea transport system makes regular links throughout the archipelago possible. And so, whereas this year Cape Verde has only produced a minute proportion of its food requirements, it hase experienced no supply problem. The same applies to Senegal, Gambia and Mauretania.

On the other hand, inland countries, which were less affected this year by the drought than the coastal region, experienced difficulty in receiving help from outside in good time. Indeed, it is not enough just to transport food to capitals or big towns, where the big communications network usually ends. They must be conveyed to the main villages in distant regions by means of a network that is often only practicable in the dry season.

This illustrates the importance of transport in the matter of distribution and also storage. In fact, at each unloading, delivery and forwarding point, it is essential to have storage capacity in proportion to the volumes handled and in relation to transport or delivery dates.

Up till now, Government authorities seem to have concentrated on equipping towns and urban centres with modern warehouses, as the map in the Appendix confirms. A few storehouses have also been built in centres in the regions most vulnerable to drought. These installations have been more particularly used to store emergency cereals sent from abroad. Since the end of the drought years, it seems that many of these outlying storehouses are empty.

During this time, producers continue to store their crops in traditional granaries. These storehouses are a familiar sight in the countryside and harmonize very well with local dwellings. Just as their materials reveal local natural resources, so their volume and number illustrate the degree of agricultural prosperity of a small region or even just a valley. For example, it is difficult not to be amazed by groups of big round stores in "banco" on the edge of the villages in the Haoussa country or by the elegant granaries mingling with the dwelling huts in the Dogon country. Logically, it is in the Sahel-Sudan region, like South of Bobo-Dioulasso, or in the more irrigated areas like the internal delta of the Niger river in Mali, that these concentrations of grain stores will be found, recalling what some people have called "the granary civilization".(1)

(1) See Jacques MAQUET, Les Civilisations Noires, Marabout Université, Verviers (Belgium), 1966.

The heterogeneity of the form and volume of these Sahel granaries makes it impossible to estimate the storage capacity they represent ; some bins in "secco", for example, only contain a few bags of grain, whereas the Haoussa granaries can contain several tens of tons. However, it is known that they contain at least the volume of one average year's crop. This gives an idea of the economic and social importance of the traditional village storage system.

At a time when the urban population is increasing faster than the rural and agricultural population, and when diets are developing in a parallel manner, the previous remarks should not be forgotten when it comes to organizing a storage system. Whether it be a matter of methods, dimensions or location of storehouses, all research work should take the following into account : the three different types of production regions - balanced regions, regions showing short crops and regions producing a surplus-, distances and means of access,market centres and consumption areas.

3. DEMOGRAPHY AND STORAGE

Whereas it has been difficult up till now to put much faith in statistics established by Sahel countries, it must be honestly admitted that the situation is improving and that some figures are more credible than formerly. This is notably the case in the field of demography. But the important aspect of periodical statistics is the trends they reveal and the degrees of evolution they indicate. Thus, the table hereafter[1] gives the growth of the population in the seven Sahel countries : between 1970 and 1975, the total population increased by 2.5 % and the rural population by 2.2 %. However, the urban population increased by 5.1 %, i.e. more than double in percentage. According to the forecast issued by the F.A.O., this trend seems to be falling off, as the figures will be respectively : 3.0 , 2.4 and 5.2 % in 1990.

It is also possible to observe the differences in demographic evolution between the countries. At present, it seems that CHAD has the greatest growth rate in the three sectors under consideration. However, in 1975, its rural

(1) Table n° 1, page 10

PARTE N° 1

TABLE N° 1

POPULATION OF THE MEMBER COUNTRIES OF C.I.L.S.S. IN 1975
(Urban, rural, total) - Estimate - (1 000 M.)

	CAPE VERDE ISLANDS	GAMBIA	MALI	MAURETANIA	NIGER	SENEGAL	CHAD	UPPER VOLTA	TOTAL
URBAN POPULATION	80	61	762	146	429	1 262	583	502	3 825
RURAL POPULATION	210	418	4 906	1 184	4 150	3 190	3 616	5 556	23 230
TOTAL POPULATION	290	479	5 668	1 330	4 579	4 452	4 199	6 058	27 055
% RURAL/TOTAL	72.0	87.3	86.5	89.0	90.6	71.6	86.1	91.7	84.3
Annual growth rate in 1970-1975 (%)									
URBAN POPULATION	-	4.1	4.6	5.6	5.4	4.3	7.2	5.3	[illegible].1
RURAL POPULATION	-	2.0	2.0	2.2	2.4	1.9	2.3	2.2	2.2
TOTAL POPULATION	-	2.2	2.3	2.6	2.7	2.5	2.9	2.4	2.5
SURFACE AREA (1 000 Km2)	4.03	11	1 240	1 031	1 267	196	1 284	274	5 307
DENSITY (M/Km2)	72	43.5	4.5	1.3	3.6	22.7	3.2	22.1	5.09

SOURCE : F.A.O. - "Perspective study on Agricultural development in the sahelian countries, 1975-1990" Rome, 1976 - Vol. I
For the Cape Verde Islands, various sources.

population represented 86.1 % of the total, whereas for Senegal this figure was 71.6 %. The Upper Volta appears at the bottom of the list as regards urbanization, as its rural population represents 91.7 of the total population. Besides, it appears that the Upper Volta is the most densely populated country in the Sahel region with a total of six million inhabitants, closely followed by Mali. But the same does not apply to their demographic density ; whereas this is 4.5 M/Km2 in Mali, it attains 22.1 M/Km2 (men per Km2) in Upper Volta, almost as much as in Senegal ; this clearly illustrates the incidence of the climatic situation (Sudan part). Only Gambia exceeds them, but its territory is very small. As far as the Cape Verde Archipelago is concerned, its population density seems exceptional (72 M/Km2) (72 men per Km2), as is its geographical situation, and enables the gravity of its present food supply difficulties to be assessed better.

If reference is now made to the Table hereafter(1), it is possible to obtain an idea of present or future storage capacities compared with the population of the countries. In percentage terms, the Cape Verde Islands seem the best equipped (103.3 Kg. per inhabitant) and Chad (4.9 Kg.) the worst equipped, that is to say the two extreme countries in respect of an outlet to the sea ; this contrast is perhaps not fortuitous. Senegal and Gambia seem more favoured compared with the other continental countries. Nevertheless, in so far as urban zones are concerned, Niger and the Upper Volta seem to be better equipped than Senegal and Mali.

If the storage capacities are measured by the number of days' reserve supply for the total population, greater homogeneity can be osberved, apart from Chad, with a low position, and inversely Gambia and the Cape Verde Islands. The average cover represents about one month (the case of Mauretania, and, better, Mali). On the other hand, far greater disparity can be observed in respect of the urban population alone. In point of fact, it is difficult to compare these figures owing to the difference between the average cereals consumption rates per country and the uncertainly of these rates. Their interest lies more in the fact that the storage under consideration here is official storage entrusted to public bodies and in underlining that States have so far essentially devoted their efforts to food problems in urban centres.

(1) Table n° 2, page 12

TABLE N° 2

OFFICIAL STORAGE CAPACITY IN THE SAHEL REGION

	Storage capacity 1 000 T. (e)			Population (millions)		Consumption (a) (Millet/ Sorghum + rice) (Kg)	Storage capacity per head (Kg)		Possible reserve in days	
	Present	Planned	Total	Total	Urban		Total	Urban	Total	Urban
UPPER VOLTA	52.0	-	52.0	6.1	(0.43)	137	8.5	(120.9)	23	(322)
NIGER	82.0	10	92.0	5.2	(0.42)	192	17.7	(219.0)	39	(416)
MALI	88.75	-	88.75	6.3	(1.00)	143	14.1	(88.75)	36	(226)
CHAD	21.0	-	21.0	4.3	(0.60)	152	4.9	(35.0)	12	(84)
MAURETANIA	14.0	-	14.0	1.5	(0.30)	115	9.3	(46.7)	30	(148)
SENEGAL	127.0	-	127.0	5.1	(1.53)	179	24.9	(83.0)	51	(169)
GAMBIA	20.9	14.5	35.4	0.5	(0.13)	179[b]	70.8	(272.3)	149	(555[c])
CAPE VERDE ISLANDS	22	9	31.0	0.3	(0.08)	182(maize, wheat, rice)	103.3	(387.5)	207	(777[d])
TOTAL	407.65	33.5	461.15	29.3	(4.49)					

(a) Source : BIRD
(b) Figures for Gambia not available ; it is supposed that they are the same as for Senegal.
(c) This figure is deceptive, there is a large number of peasants in Gambia, who, like nearly all the urban population, consume grain without being producers.
(d) As previously, many rural inhabitants in the Cape Verde Islands are not agricultural producers, which lends litte little significance to the figure for reserves in urban areas.
(e) In the process of being built or already financed.

This is clearly illustrated in the agro-climatological map mentionned previouly :

by examining the places where storage installations have been set up, it is possible to get a fairly accurate idea of where the urban population is. It appeared advisable to add a map[1] showing the population figure for each region per country, so as to compare the demographic density between country and town areas, between the rural population and the urban population.

4. FOOD SUPPLY AND STORAGE

Problems of consumption must now be discussed. It is known that the basic food in the Sahel consists of cereals ; at least as far as sedentary populations are concerned, for shepherds and stock breeders consume more meat and milk products, and nomadic groups consume large quantities of milk also.

This first observation already explains that sedentary farmers are more vulnerable to climatic hazards and risks of scarcity than people on the move. Indeed, they cannot change their region and do not have any considerable food resources apart from food crops, mostly cereals.

Customs in the matter of food and social traditions must be taken into consideration. Meat is generally kept for special circumstances, for example feasts or entertainment ; but it is a question of chicken meat or small cattle meat. Adult cattle, often entrusted to shepherds, are considered as items of prestige and long-term capital, designed for exceptional purchases or very big festivities.

However, some products accompany the basic dish in the form of vegetables and condiments and produce additional food (ground-nuts, fruits). They can act as replacement products ; this is the particular case with "niebe" and "fonio", which the women often keep for the period between crops .

The following table gives an idea of how the food intake is composed in the various different countries.[2]

(1) See the second map in the Appendix
(2) The Cape Verde Islands are missing, as they were not yet a member of CILSS. Table n° 3, page 14

TABLE N° 3

CONTRIBUTION OF ENERGY PER PERSON AND PER DAY OF THE VARIOUS GROUPS OF FOODSTUFFS IN THE DIFFERENT COUNTRIES AND THE PERCENTAGE OF THIS CONTRIBUTION IN THE TOTAL RATION

	SENEGAL		GAMBIA		MAURETANIA		MALI		UPPER VOLTA		NIGER		CHAD	
	Cal.	%	Cal.	%	Cal.	%	Cal.	%	Cal.	%	Cal.	%	Cal.	%
Cereals including	1 809	66	1 822	72	1 298	60	1 692	76	1 421	75	1 706	76	1 583	65
Millet and sorhum	882	32	852	34	936	43	1 328	59	1 217	64	1 627	72	1 450	59
Roots and tubercles	116	4	44	2	12	1	78	3	38	2	100	4	74	3
Sugar	178	6	98	4	211	10	49	2	21	1	27	1	45	2
Leguminosae (Vegetable substances)	49	2	24	1	68	3	41	2	190	10	131	6	213	9
Oil-yielding products (1)	308	11	418	16	45	2	175	8	127	7	80	4	338	14
Vegetables and Fruit (2)	23	1	20	1	40	2	22	1	15	1	15	1	29	1
Animal products (3)	254	9	109	4	504	23	178	8	77	4	196	9	164	7
TOTAL	2 737		2 535		2 178		2 235		1 889		2 255		2 446	

(1) Including vegetable oils.

(2) Including spices .

(3) Including butter and animal fats.

Source : Nutrition Division, FAO

On this table, it is easy to note the marked inequalities existing between the different countries. But the latter do not coincide exactly with the previous divisions. Indeed, whereas Senegal and Gambia are still privileged, Chad follows them closely, way ahead of Mauretania, which is less well placed than Niger and Mali, the last country being in this case Upper-Volta. The first explanation that comes to mind is proximity to water and fishing possibilities, whether they be maritime as for Gambia and Senegal, or in lakes and rivers for Chad, Niger and Mali. This may be deemed confirmed by the fact that fish consumption is very low in Mauretania and fishing is no significant in Upper Volta.

The table shows that the other sources of food are mainly sugar, oil-yielding products and animal products, including fish. The distinction between coast and inland then appears, adding Chad to the first category, as this country is rich in oil-yielding and vegetable products.

This distinction would doubtless be still more patent if consumption in the main towns in all the countries were compared. Failing this study, it is at least possible to study the evolution of food habits in urban areas.

It only requires a short stay in the capitals of the Sahel region to see that more and more bread is being sold. The same applies to rice, especially in countries on the coast and in Chad, as the following table shows.(1)

But it must also be noted that maize holds a non negligeable rank -practically on equal terms with wheat- mainly in Senegal, Mali and Upper Volta. This proves the increasing importance of maize in food supply of Sahelian Populations both on the coast and inland, and the future development of this cereal because of its production (it requires less water than rice and is better adapted than wheat) and consumption (couscous and broken grains that may be compared with those of rice and wheat) in the Sahel countries.

(1) Table n° 4, page 16.

TABLE N° 4

CONSUMPTION OF CEREALS

Estimates - (kg/person/year)

	RICE	WHEAT	MAIZE	MILLET/ SORGHUM (a)
CHAD	7	3	2	145
MALI	20	3	10	123
MAURETANIA	17	14	2	98
NIGER	6	1	2	186
SENEGAL	56	22	15	123
UPPER VOLTA	4	5	10	133
GAMBIA AND CAPE VERDE ISLANDS	Not specified			
TOTAL	110	48	41	808

SOURCE : BIRD - West African Food Grain Study - Washington 1976

(a) including all the other cereals, such as Fonio.

The main rice consumer countries are also countries that produce and even export rice, but they also have to import some. This is the case especially with Senegal, which sells its better quality rice and buys broken rice. As for wheat, it is almost entirely imported. This is why they are expensive foodstuffs, especially bread which is a transformed product.

But nevertheless, rice and wheat consumption is rising, as a recent survey carried out by "L'Office de Recherche pour l'Alimentation et la Nutrition Africain in Dakar has proved. The interest of this thorough survey, carried out not only in Dakar but also in two small towns inland, Louga and Linguère, lies in the fact that it studied family expenditure by income layers. Now, the results were practically identical for the different layers : out of a total expenditure on cereals, representing almost 30 % of the amount spent on food, rice and wheat together represent practically 90 % (89.5 exactly, i.e. rice : 16.9 + wheat : 9.7 = 26.6 %, compared with a total consumption of cereals of 29.7 %).

These figures should throw light on the extent and rhythm of the evolution of feeding trends. Of course, all Sahel countries have not reached the same level as Senegal, where the national dish is rice with fish. Nevertheless, these figures confirm the tendency that can be seen to be spreading in urban Sahel areas, before they slowly reach rural districts.

This is why these results should not be forgotten when discussing agricultural production and policy

(1) See O.R.A.N.A./F.A.O. "Enquête de consommation alimentaire et nutritionnelle" Dakar, Senegal - June-July 1977" - Dakar, May 1978.

5. AGRICULTURE AND STORAGE

With agriculture, we come to the main factor in the overall food supply system referred to above, production. All the links in the chain depend on it. It is really the source of food.

Now, as is well known, this production only just satisfies requirements and is often insufficient for them. This is a precarious and unstable situation, which the inhabitants of the Sahel regions have experienced for a long time, and whose traditional "dry" agriculture depends entirely on the rainfall(1).

It had been hoped that new methods, especially those introduced since independence, along with productivity programs, notably irrigation would have made it possible to change this dependence and fragility. Unfortunately, whereas some progress has certainly been made, it hase not been sufficient to improve the situation, but only to follow the population increase, as the table on the following page shows(2). Indeed, while these figures are not quite exact, they do show that the annual production per person was roughly the same in 1975 as it was in 1970, if not slightly lower (i.e. 175.7 Kg as against 176.3). Now, 1975 was considered a good year, coming after the deficit during the great drought.

Demographic growth has other consequences, in particular on deforestation and on the extension of herds, above all small cattle ; this leads to overgrazing. But it does not explain everything. The stagnation of(3) agricultural productivity that often has to be deplored proves that, over and above deficiencies of a technical nature, two essential factors had perhaps been overlooked : soil capacity and the co-operation of men.

As stated above, the fragility of the soil in Sahel regions meant that they could only continue to exist thanks to the fallow system. The reduction or suppression of this practice entails consequences that it is difficult to remedy, especially when it is a question of very arid soils in the Northern

(1) Hence, in parentheses, the importance of granaries which, when the harvest is good, make it possible to establish reserves against bad years.
(2) Table n° 5, page 19
(3) See, for example, Vol. I of "Perspective Study" by the F.A.O., already referred to, page 86.

TABLE N° 5

POPULATION, CONSUMPTION AND PRODUCTION IN 1970-1975

1970	CAPE VERDE ISLANDS	GAMBIA	MALI	MAURETANIA	NIGER	SENEGAL	CHAD	UPPER VOLTA	TOTAL/GENERAL AVERAG
POPULATION (thousands inh.)	-	429	5 047	1 171	4 016	3 925	3 640	5 384	23 612
CONSUMPTION (thousands of tons)	-	74.4	903	158	696	739	624	802	3 996.4
PRODUCTION OF CEREALS (thousands of tons)	-	71	852	84	1 139	500	650	867	4 163
Production/Population ratio: quantity available per head per annum	-	165.5	168.8	71.7	283.6	127.4	178.5	161	176.3
1975									
POPULATION (thousands of inh.)	290	479	5 668	1 330	4 579	4 452	4 199	6 058	26 855
CONSUMPTION (thousands of tons)	52.8	83.2	1 025.8	183.1	798.8	855.7	728	912.6	4 640
PRODUCTION OF CEREALS (thousands of tons)	12	64	1 125	30	864	753	634	1 239	4 721
Production/Population ratio : quantity available per head per annum	41.3	133.6	198.5	22.5	188.7	169.1	151	204.5	175.7

SOURCES : - For population and consumption : F.A.O. "Perspective study". Vol I, II and III (Statistics and forecasts) 1976.
- For production : Report and drawn up by C.R.E.D./Michigan, Vol I (from F.A.O., B.I.R.D. and F.M.I. sources) 1977.

part of the Sahel region. Irrigation is one of the means of improving crops, but it requires costly investments.

An economic problem therefore arises and this is perhaps the moment to bring up a controversial question, namely the relative merits of "paying crops" and "food crops" . Following the commercial and colonialist custom of the colonial period, the governments of Sahelian countries continued to encou - rage the growing of crops for export by favouring them by all kinds of technical, financial, administrative and commercial advantages. The consequence was that cereal crops were often treated as poor relations : land of inferior quality, less work, no fertilizers, no irrigation.

The great drought was the occasion when peasants started to consider matters : they had debts (various investments) and the reserves in the granaries had vanished. And so, some of them began to change their methods and to give priority to food crops, henceforth considered as "paying" crops.

Public Authorities should give producers real incentives -in both financial and technical fields- (by providing information on crops, farming methods, seed, tools) so as to encourage them to intensify and improve their food crops. They would thus help public opinion to discard this out-of-date opposition and to understand that the solution does not lie in sterile competition between two types of production, but in developing them side by side in a complementary manner. They would also, above all, enable farmers to regain confidence in themselves and in the State, and to find a place worthy of them in the nation and in its development work.

6. POLICY AND DEVELOPMENT

Whereas it is indeed a question of the Sahelian countries ensuring their economic and social progress, this must not be achieved to the prejudice of their independence. Now, food security is surely the first condition of liberty. This is why promotion of a vigorous agricultural policy must be a priority task.

In saying this, we are not moving away from storage problems. The proposals for setting up a system or strategy which we considered had to take two main hypotheses into account, either a chronic deficit as at present, or self-sufficiency in the matter of food supplies. As there cannot be any question of accepting the first, which would bring penury and loss of independence, it seems that the second is not "sufficient" ant that it will be necessary to turn to a third option : production of a surplus. Indeed, if big cereal producing countries are self-sufficient, it is because they have a surplus or because of the extent of that surplus.(1) In other words, self-sufficiency pre-supposes the usual existence of surplus.(2)

There remains the question of the use of these surplus. Apart from constituting or re-constituting as big reserve as possible, following the good old peasant tradition, a factor in the answer is already supplied by the tests and the first efforts to transform local cereals : millet and sorghum flour used in making bread, millet couscous, various preparations based on sorghum, etc...

All these prospects may appear optimistic or even illusory in the face of the trends mentioned above and the weight of foreign influences. But perhaps too little faith has been put in the deep aspirations of men and their desire to shoulder their responsibilities. Traditional storage is a good example of this : it provides peasants with a means of ensuring the livelihood of their families and thus achieving dignity, not to mention pride in being able to feed his fellow beings ; to the men who build the granaries, it provides an opportunity to exercise technical skill ; to the women, who manage the employment of the grain, it brings authority ; on the head of the family, it confers power, the power to control his production, and social prestige that embraces all the family. All these values must in no case be ignored when talking of organizing and setting up a grain storage system.

Rather than searching to affirm their power at all levels and at any price ; would it not be to the greater interest of government authorities to encourage and support all genuine steps taken in the matter of training research,

(1) The case of the U.S.S.R. is enlightening in this respect.
(2) This is the case of the USA which have understood that with agriculture showing a surplus intentionally, they can thus have powerful cards for economic (monopole, dumping) and political pressure ("the food weapon").

creation, exchange and partnership, which denote a people's vigour, and without which no durable promotion nor any real community are possible.

7. SYNTHETIC TABLE AND METHODOLOGICAL RESEARCH

A recapitulative table of the means now available and the theoretical storage requirements in the Sahelian countries will make it easier to understand the capital relationship existing between basic consumption and cereals storage in any one given country(1).

7.1 Hypotheses and Parameters

This table has been essentially based and compiled on what is called the "security co-efficient" ; it is the basic factor in all calculations.

Fixed in an arbitrary manner by the conditions governing supplies in each country, that is to say mainly climatology, and means of access and transport (distances and time), this term expresses in percentage for the capacity of a country to cover its normal requirements in the matter of food supplies. And so, for example, compared to theoretical security of 100 %, it is estimated that Senegal has a guarantee of 90 %. To attain complete security (100 %), Senegal will therefore have to have an additional reserve of 10 % available, i.e. a cover of 100 + 10 = 110 %.

Hence the establishment of a compensation rate : it is a multiplication factor that ensures supplies, for example a security stock of 100 %, that is to say it compensates for the margin of insecurity ; thus, in Senegal, this rate is 110 %.

(1) See table n° 6, page 24.

Regulating stock and security stock

The definition of different types of storage and their functions will be given hereafter. It should be recalled here that it is solely a matter of public enterprise storage. This is why only urban consumption has been considered in connection with the regulating stock, whereas the security stock concerns the total consumption. In order to be able to estimate the requirements of the regulating stock, a basic figure of 25 % of the urban consumption has been taken, and, for the security stock, a figure of 6 % of the total consumption.(1)

Population and consumption

The urban population figures are calculated by simple subtraction based on the rural population rates given in the "Perspective study" issued by the F.A.O. (See table n° 1, page 10). They have been used in their turn for calculating the urban consumption figures of the basis of the total consumption data given in the same document (See table n° 5, page 19).

Calculation of capacities

The amounts of "necessary regulating storage" and "security storage" (necessary) therefore correspond to the corresponding stocks required by the "Security co-efficient", that is to say multiplied by the "compensation rate". The sum of these two capacities ("total capacity necessary") is compared to the "present capacity" to give a positive or negative difference.

A final percentage calculation was made to bring out the numerical relationship between "necessary storage" (overall capacity) and "total consumption" in each country.

(1) Hereafter will be found a note justifying this 25 % rate ; as for the 6 % for the security stock, reference should be made to the last chapter of the "General Report" (Vol.I.,6.3).

TABLE N° 6

STORAGE : SURVEY OF EQUIPMENT AND REQUIREMENTS

(According to the urban consumption in 1975 and the "Food security" in each country)

BASIC DATE	CAPE VERDE ISLANDS	GAMBIA	MALI	MAURETANIA	NIGER	SENEGAL	CHAD	UPPER VOLTA	AVERAGE TOTAL
Security co-efficient (%)	50	90	80	50	65	90	75	75	71.87
Compensation rate (%)	150	110	120	150	135	110	125	125	128.12
Urban population (%)	28	12.70	13.50	11	9.40	28.40	13.90	8.30	15.65
Total consumption (1 000 T.)	52.80	83.20	1 025.80	183.10	798.80	855.70	728	912.60	4 640
Urban consumption (1 000 T.)	14.78	10.56	138.48	20.14	75	243	101.19	75.74	678.89
Theoretical regulating stock (1 000 T.)	3.69	2.64	34.62	5.03	18.75	60.75	25.30	18.93	169.71
Theoretical security stock (1 000 T.)	3.16	5.50	61.54	11	47.92	51.34	43.68	54.75	278.89
STORAGE AND SECURITY									
Necessary regulating storage (1 000 T.)	5.53	2.90	41.54	7.54	25.31	66.82	31.62	23.66	204.92
Security storage (1 000 T.)	4.74	5.50	73.84	16.50	64.69	56.47	54.00	68.43	344.77
Total capacity necessary (1 000 T.)	10.27	8.40	115.38	24.04	90.00	123.29	86.22	92.09	549.69
Total present capacity (' 000 T.)	31	35.40	88.75	14	92	127	21	52	461.15
Difference between the two totals	+ 20.73	+ 27	- 26.63	- 10.04	+ 2	+ 3.71	- 65.22	- 40.09	- 88.54
Ratio between necessary storage and total consumption (%)	19.45	10.09	11.24	13.12	11.26	14.40	11.84	10.09	12.68

7.2. A few observations

No effort will be made here to justify the hypotheses or the bases of calculation, which, it must be admitted, were chosen arbitrarily. Only the most important one will be dealt with here, that is to say the "Security co-efficient".

Indeed, in so far as the latter takes the different natural advantages and disadvantages of each country seriously into account, it enables the differences or divergences between the countries to be assessed and balanced. It is a kind of approach method to reality, where approximate magnitudes are more important than absolute figures.

If comparisons had to be made, it would be noted that the two extremes lie in coastal (or even insular) countries : on the one hand, Senegal and Gambia, and on the other Mauretania and the Cape Verde Islands. Alghough the latter now produce less than 10 % of their requirements, their access and transport facilities endow them with a theoretical "Security co-efficient" of 50 %. On the contrary, the four inland countries have an average co-efficient of about 75 %, in spite of a good production year (1975), owing to their difficulties with access and communications. In this connection, reference can be usefully made to the table and the second map in the Appendices[1], which illustrate better than words what territorial incirclement means and the dependence accruing therefrom.

Besides, it will be noticed that the other parameter distinguishing the countries to a considerable extent and influencing the results to a marked degree is the urban population rate. And so, although their total consumption is much lower than Gambia's, the Cape Verde Islands require far greater regulating storage, owing to the high urban population rate (equal to that of Senegal). This contrast appears even more clearly in the percentage ratios between the necessary storage (total) and total consumption (last line in the table).

Apart from the Cape Verde Islands, Senegal and Mauretania, this ratio oscillates between 10 and 1[illegible] for the other countries. The average (12.68) may be

(1) Table n° 7 : "Possibilities concerning transport of foodstuffs from the principal ports to countries that are encircled" and map of the population density.

taken as indicating what the proportion should be between national consumption and public enterprise storage in the present urbanization conditions (15.65, average). It would obviously increase with demographic growth and sociological evolution. One of the advantages of this table is that it shows a number of possible figures varying with the food security rate. In this connection, it has some value for estimating future prospects and is not merely applicable to a proximate situation.

For the moment, the great diversity of equipment available in the various different countries is striking. Whereas four of them reveal a positive balance, four others show a deficit, especially Chad, Upper Volta and Mali. This is regrettable when the geographical constraints of these countries is remembered(1). Furthermore, it should not be forgotten that the figures for storage capacities are quite recent (1978), whereas those for population and consumption date from before 1975.

This is why too much reliance must not be placed on the figured results of a table of this kind. Its real interest is theoretical as a contribution to methodological research on calculating storage requirements for any given country or human group.

(1) To obtain an estimate of the present storage capacities in number of days, reference must be made to table n° 2, p. 12. When estimating regulating storage requirements, it might have been possible to take one rotation every six months, i.e. two rotations per annum. But that would have meant dividing capacities in half, that is to say reducing the number of days' reserve for Chad, for example, to 25 and that of the Upper Volta to 20. In the conditions existing at present in countries in the Sahel region, it was estimated that it was impossible to take such risks.

II - RECOMMENDATIONS AND PROPOSALS

The conclusions reached in the General Report are of two kinds : firstly, a proposal for alternative diagrams for the organization of cereal storage according to the classic distinction "Public Enterprise"/"Private Enterprise" ; and secondly, practical recommendations for improving existing technical processes and an effort to make the economic systems function as well as possible.

But, first of all, the principal functions of storage must be distinguished and defined.

1. FUNCTIONS OF STORAGE

The principle of storage is to build up a reserve making it possible to satisfy a demand which does not follow as regards time the same law as the source of supply. Supply may be continuous and regular and demand may be sudden and limited in time. On the contrary, supply may be discontinuous and demand continuous. It is the latter aspect that applies to food products. The harvest is an annual event and is spread over one or two months. It can vary considerably depending on climatic conditions. Demand corresponds to the populations's consumption. This demand is continuous and increases regularly ; it is nevertheless influenced by social phenomena like seasonal migrations or seasonal variations in feeding customs.

On the basis of this general definition, four main types of storage can be distinguished :

- current storage : this is normal distribution storage ; it consists in building up a reserve to supply a stable and regular consumption demand during a given period.

- transit storage : this storage is due to a break in the load in a transport chain. It serves to take delivery of a consignment of merchandise which will leave sometime later, either wholly or partially. It also serves to re-group consignments from different origins to make up a bigger consignment.

- regulation and stabilization storage : this storage forms part of the commercial circuit where the law of supply and demand prevails ; it also acts as a counter to the effects of speculation.

It thus consists of a reserve from which merchandise can be taken to regularize the flow and stabilize prices on the market. In this case, the timing of any such intervention is more important than the quantity.

- emergency storage : this storage is designed to constitute reserves sufficient to ensure that there will be no penury of foodstuffs even if exceptional supply difficulties arise. The following come under this heading :
  - subsistence storage,
  - reserve storage,
  - storage for use on urgent occasions or in emergencies.

2. PROPOSAL FOR ALTERNATIVE SCHEMES

Basic data

First of all, the parameters or basic data guiding the choice and definition of these proposals must be recalled. Amond the factors in question, a distinction can be made between those concerning production, with geographical and climatic variations, and those concerning consumption, with differences of a demographic, sociological (growth of the population, distribution between rural and urban areas) and economic (self-consumption/market) nature, and finally those concerning distribution (transport, marketing) and management (private enterprise, public enterprise).

These different parameters are constantly intervening and can be placed under three headings : economic, sociological and political.

In connection with the first -economy- the hypothesis concerning production will be above all retained. To illustrate the irregularity of cereal production, two forms of agricultural year have been taken : the first, normal or balanced (100 % of production) and the second showing a loss of 20 % (80 % of production), i.e. a relatively high deficit percentage.

As far as sociology is concerned, it is essential to know what the proportion of the urban population is in relation to the total population to determine

urban consumption, based on market deal and rural auto-consumption. This proportion is far from being the same in each country and so a theoretical uniform rate of 20 % has been selected for the urban population[1].
In respect of the political field, this concerns essentially the actors present : the peasants (producers, consumers and merchants), the State (public enterprise, and sometimes semi-public and co-operative) and the merchants (private enterprise).

Principles

Besides, in the matter of storage proper, a basic distinction has been made between stabilization storage and security storage. The first is a matter of current distribution, that is to say of supplying markets and regulating prices during the course of one single agricultural year, and for this reason is called "intra-annual" storage. The second constitutes the emergency reserve for use on urgent occasions or in the event of a calamity ; it therefore extends over a longer period, generally several years ; hence its name "pluri-annual" or "inter-annual" storage.

A series of parameters or criteria are thus obtained, which can be classified in the following manner :

- Periodicity : "intra-annual" storage,
  "inter-annual" storage,
- Location : throughout the territory,
  urban areas,
  rural or peasant areas
- Management : peasants,
  States,
  merchants
- Structure : State control : total,
  partial,
  none.

(1) In fact, according to the estimates drawn up by the F.A.O., it was already more than 15 % in 1975 and will probably be about 20 % in 1990. For greater accuracy, see table n° 1, page 10.

These various parameters do not affect the two types of storage to the same extent. Indeed, in view of the social and political importance of food security, it has been estimated that inter-annual storage could in no case be entrusted to private enterprise. This is why only intra-annual storage is concerned by the three degrees of State intervention.

If these various data are recapitulated, the following hypotheses are obtained :

A/ Inter-annual storage : always State controlled but may be extended to cover the whole country or only urban areas, i.e. two options.

B/ Intra-annual storage : can be entirely or partially State controlled or not State controlled at all ; the first two cases can each be divided up into 2 possibilities : "the Whole country" or "urban areas", i.e. five options in all.

If these two series of options are combined, 10 possible figure cases are obtained (1).

This calculation of options has made it possible to draw up the various different alternative proposals to find a solution. Only five of these proposals seemed worthy of further attention. The main characteristics are outlined succinctly below. To have further information one must refer to the attached diagrams which illustrate each of the solutions.

Alternative solutions

1/ Alternative I-1

Inter-annual storage : complete monopoly of State enterprise
Intra-annuel storage : complete monopoly of State enterprise

The consequence appear very heavy from the economic aspect (investments, infra-structures, with a storage capacity amounting to 81 % of production), and from the social point of view (destruction of social structures and traditional means of storage).

(1) In fact only nine, since the solution where intra-annual storage is completely State controlled and inter-annual storage reserved for urban areas is incoherent.

2/ Alternative II-1

Inter-annual storage : State controlled for the entire country
Intra-annual storage : State controlled for urban areas

Normal year : peasants are responsible for constituting their own intra-annual stock.
Year showing a deficit : rural areas showing a deficit are supplied from State controlled stocks and by imports ; urban areas are still supplied by the State.

3/ Alternative III-1

Inter-annual storage : State controlled for the entire country
Intra-annual storage : Partially State controlled (stabilization stock) ; The State intervenes on all markets, but only controls 25 % of the volumes handled(1).

4/ Alternative IV-2

Inter-annual storage : State controlled for urban areas
Intra-annual storage : Partially State controllet for urban areas

Normal year : the State is only responsible for a part of the storage for urban areas (inter-annual stock + 25 % of the intra-annual stock), and private enterprise is responsible for 5 % of intra-annual storage. Peasants are responsible for constituting their own storage, both inter-annual and intra-annual.
Year showing a deficit : rural areas showing a deficit will be supplied from their own reserves. Deficits in supplies to towns will be made up from the official inter-annual stock. Imports will be used to complement supplies to towns and areas showing a deficit, while at the same time re-constituting the inter-annual stock for urban areas.

5/ Alternative V-1

Inter-annual storage : State controlled for the entire country

(1) The rate of 25 % is currently considered sufficient to control market prices.

Intra-annual storage : No State intervention. It is completely ensured by private enterprise (peasants and merchants).

Normal year : the State's role is limited to rotation of the inter-annual stock.
Year showing a deficit : the State intervenes depending on the gravity and the extent of the penury, notably by means of imports.

Critical analysis

The alternative proposals just described are essentially attempts to determine different possible storage systems, by outlining the organizational aspects of each formula and by showing its structural, economic, social and political consequences.

In each of these fields, one of the major problems requiring solution is the question of distribution of the roles, charges and responsibilities between public enterprise (i.e. the State) and traditional circuits(1).

Indeed, it must not be forgotten that in the Sahel region, like in all traditional civilizations, the local populations managed to find effecient solutions both for circulating and exchanging products and for agricultural production and storage proper. These populations, including some groups specializing in some social or professional activity or other, were well able to adapt themselves to the new conditions governing exports of agricultural produce and the market economy.

Furthermore, the gravity of the agro-economic situation, which people are beginning to realize it is not solely climatic in origin,(2) makes it essential to take into account the lack of balance between regions showing a deficit and those not showing a deficit -regions with fairly unstable frontiers and whose deficits are often unequal- and has led to great importance being given to the distinction between intra-annual storage, for current supply, and inter-annual storage destined to achieve security of supplies.

(1) By traditional circuit is meant both agricultural producers and the privately owned trading houses ; when it is a question of production-consumption, peasants and rural areas (whether showing a surplus or a deficit) are those referred to ; when it is a matter of transport and distribution, it is a question of private enterprise.
(2) See the works of the "Sahel Club", carried out in close collaboration with CILSS, and especially the "Medium-term prospects" summarized in "Marchés Tropicaux", N° 1705, dated 14.07.78, p. 1910.

From the aspect of structures, the possibilities for State intervention are very varied, since they oscillate between 3 and 81 % of the storage capacity required to store production. This entails very different consequences which deserve to be quantified. Although it is not easy to quote accurate figures, it is nevertheless possible to give some rough idea of their size.

And so, for big countries like Niger and Mali, storing more than 80 % of normal production means managing a stock of more than a million tons. If the cost of official storage is now nearly 15 000 F.CFA/ton, as the calculations in Chapter IV[1] have shown ; if the cost of marketing is added, that is to say according to official sources about 20 F.CFA/Kg, and if the part covered by official margins is deducted (10 to 15 F.CFA/Kg), the amount of the deficit at the charge of the State could amount to from 20 to 25 milliard F.CFA per annum, i.e. almost half Mali's national budget.

Is there any country in the Sahel region that could be capable of devoting half its annual budget to a subsidy for consumption ?

Almost more worrying from the economic point of view is the obligation to double the distance to be covered by some cereals. Indeed, after the harvest, they would have to be sent to storage centres, and later during the year, sent back to rural areas for consumption there. Even if the average distance is not very big, it nevertheless represents an expenditure of effort and time which may be considerable and which the village storage system could have avoided.

Finally, the size of the loss rate, probably greater in official storehouses than in traditional granaries[2], has repercussions on the quantity of cereals required to achieve self-sufficiency. If 10 % more grain is lost in official storehouses, 10 % must be produced in equal proportions to attain the same available quantity. It is for all these reasons that any alternative, in which the State is responsible for intra-annual storage for rural areas is economically inacceptable.

(1) in "Rapport Général", Tome I.
(2) In the "Rapport Général" (Vol.I,4.1 and 5.2) indications in figure form will be found on the losses observed in various means of storage and the corresponding charges.

The role of traditional private enterprise is inversely proportional to that of public enterprise, since the former is responsible for, or better still continues to be responsible for, the part of grain storage not taken over by the State. Whereas it is difficult to give the exact cost of investment and management here, there is no risk in stating that it is not very high financially speaking(1).

What appears to be the most important factor to stress in this matter of competitive or complementary distribution between private and public enterprise is the possible increase in charges that may occur at rural level. Indeed, apart from Alternative I-1., traditional enterprise is entrusted with storage of a large proportion of grain (between 73 and 97 %). Of course, it is not only a question of farmers, as many merchants possess private storehouses. But it has been seen that the capacity of the latter is fairly small, and even if it were possible to increase their number considerably(2), it would be a long time before their capacity was comparable to village granaries.

In the meantime, reliance will have to be placed on traditional storage. The fact that it is a question of a custom whose economic value needs no longer be demonstrated, is no justification for leaving it to its own devices. To the extent that society relies on peasants to be responsible for subsistence storage, not only for rural areas (Alternatives II-1 and III-1), but also for urban areas (Alternatives IV-2 and V-1), not to mention security storage for rural areas (Alternative IV-2), it must set a value on this irreplaceable economic activity and allow it to be remunerated equitably. This means that the prices offered on markets should cover the whole of the cost price, including the cost of storage. If prices do not rise during the course of a year, and if farmers do not receive some advance payment on their crops, intra-annual storage is not remunerated.

Furthermore, the State can offer additional economic incentives, such as sums advanced on harvests, credits on grain stored, etc..., as many co-operative-type associations already do. These various forms of credit would make peasants more independent and above all give them a possibility of not selling their crops

(1) In the "Rapport Général" some information will also be found on comparative costs of improvements to traditional storage methods and of modern storage management (Vol. I, Chap. V).
(2) Provided it is financially interesting.

at the end of the harvest at no matter what price. And so he could benefit from the rise of prices on the market a some time during the year, a rise from which only private merchants normally profit.

The mention of co-operative formulae means also raising all the problems of training and responsibility, two realities that are inseparable. The study on traditional storage has revealed that success in any development project or program in rural areas depends on careful preparation and on exchanges and concertation with the interested parties, all things that require basic training and training for future executives.

3. PRACTICAL RECOMMENDATIONS

The technical field

Too much time will not be spent on the technical improvements in modern installations, which are somewhat classic ; but, it is worth mentioning that anti-parasite measures and measures in the interest of health seem to be the most important to introduce. To a still greater extent, special attention should be paid to the problems of management, organization and accounting, etc... and should comprise priority training courses for the staff and even for all farmers.

Furthermore, improvement of traditional storage methods should not be forgotten and even seems of the greatest interest when its economic and social importance is considered (80 to 90 % of present-day storage). Starting with various initiatives, both as regards technical building and preserving methods, and as regards organization and management structures, various methods are compared and figures quoted in support of them, and it is suggested that these experiments should be increased in number and more widely introduced to enable the peasant world to benefit fully from them(1).

The economic field

The study of storage problems concerning cereals in Sahel countries ended up in a number of alternatives being identified. They represent a number of political choices enabling the populations of the countries in question to

(1) See in the "Rapport Général", Chap. V.

be supplied with their food normally and have self-sufficiency in the matter of food as their medium-term target.

A time-schedule remains to be set up for the actual interventions within the context of the policy chosen. To do this, additional analyses are necessary ; in fact, as the study was the first ever undertaken for all the Sahel countries, it could not have an accurate definition of the action to be taken as its objective.

To pass from the present phase to the operative one , it seems reasonable to consider four stages :

- a study of production and consumption,
- a study of the maximum possibilities of each alternative,
- a detailed study of the alternative selected,
- a study of the financial and commercial organization of the official intervention bodies in the field of cereals.

1/ Study of production and consumption

The general study undertaken on the countries in the Sahel region revealed a necessity to determine as accurately as possible the quantities consumed by the local populations and the amount produced in the different countries.

At the same time, it appeared that there were still considerable lacunae at this level :

- the total production figure and consumption per product and per country is very insufficiently established ;

- the investments required and the action to be taken to raise production to a suitable level are still insufficiently known and no coherent policy has yet been defined ;

- rapid evolutions occur more and more, notably in urban population in the countries concerned. It also appears that feeding habits are changing more and more towards European-type habits. This leads to an increase in the

consumption of the cereals normally produced in temperate countries to the detriment of traditional African products.

An analysis of production and consumption per product and per country is a difficult undertaking and it is not feasible to consider studying it in detail. Nevertheless, it is possible to determine some reasonable guide-lines based on the study of existing statistics, completed and corrected by incidental studies on the evolution of feeding habits, and on an estimate of the basic tendencies that are apparent.

2/ Study of the maximum possibilities of each alternatives

Once the consumption and production per product and per country have been determined as accurately as possible, an analysis in detail must be made of the various alternatives selected to achieve the targets laid down.

As has been seen, several alternatives exist. These different alternatives comprise constraints that are political, sociological, technical, financial and economic. Responsible political authorities will have to be informed as accurately as possible of these various constraints, so as to be able to make a reasonable choice.

To do this, the maximum possibilities of each alternative, both as regards production and distribution, must be developed in full, before any one is selected.

This requires setting up optimization models, the optimization criterion being at this level the minimum present-day cost.

Each alternative will then have its own cost label.

Moreover, all the extra-economic considerations should also be taken into account. The latter fall within the domain of responsible political authorities, who will then be able to make a choice guided by the quantified characteristics of each alternative.

3/ Detailed study of the alternative selected

Once an alternative has been selected at the end of the second phase, it must then be applied. For this purpose, a detailed program of interventions must be drawn up laying down the equipment to be installed,the personnel to be trained, the administrative organization to be set up and the financing required.

This is the object of the third phase.

4/ Study of the financial and commercial organization of the official intervention bodies

No matter what the final instructions to cereal boards within the context of the selected alternative may be, it will be essential for official intervention bodies to have a modern management system. In fact, it is not possible to envisage introducing a valid storage policy unless those responsible for this policy have a number of economic analysis instruments available to them, enabling them to make an exact appreciation of their activities at any moment.

Setting up a commercial, accounting and simple administrative organization, in view of the real state of affairs in the countries concerned (personnel with little training, difficult means of communications, etc...),can only be progressive and only requires a limited investment in personnel and supplies at the outset. This organization must be the result of a specific study and must be given a modern management instrument by the cereal boards. This study should also include a definition of the departments called upon to execute the various tasks and the broad lines for relevant staff training.

CONCLUSION

A study of this kind is of the greatest importance after the serious consequences of drought in recent years, and the new alert appeared this year. It reveals that technical solutions for storing cereals exist, starting with traditional methods, which still play an irreplaceable part, but whose efficiency depends for a large part of political decisions.

This is why it is important to distinguish two conclusions at the end of this study. As has been seen, storage lies between the two ends of a chain, consisting of production and consumption. In both cases, it is a matter of the basic food supplies for populations, that is to say their subsistence. The State is compelled to play a responsible part in this sphere.

But the State cannot do everything. Its role is to ensure that the supply system functions properly. It is reasonable that the State should reserve the right to organize and control security storage ; this is not a commercial operation but a national duty, which has its price.But the same does not apply to current storage. Daily experience proves that peasants, that is to say the producers, know very well how to store and preserve their grain at minimum cost. No official body could fulfil the same task so cheaply. This is why all States should deliberately encourage peasant storage, while at the same time ensuring that producers have sufficient funds available until such time as they sell their crops.

As far as urban areas are concerned, if the intervention of Government bodies is necessary, in particular for stabilizing prices, it can vary according to the policy applied by the State. The alternatives mentioned above propose several different degrees of control for public enterprise. It is up to Government bodies to choose a method of intervention that takes the particular conditions prevailing in their country into account and that is sufficiently flexible to be efficient in all circumstances.

In conclusion, it is hoped that this study will not be separated from the other projects being undertaken to develop the Sahel region, particularly those concerning agricultural production and the fight against ecological,

sociological and economic imbalance, so that the target of self-sufficiency in the matter of food does not remain an illusory prospect. Here again, it must be repeated, it is a matter of political will, training men and international solidarity.

APPENDICES

TABLE N° 7

POSSIBILITIES OF TRANSPORTING FOODSTUFFS FROM THE MAIN PORTS TO THE ENCLAVED COUNTRIES

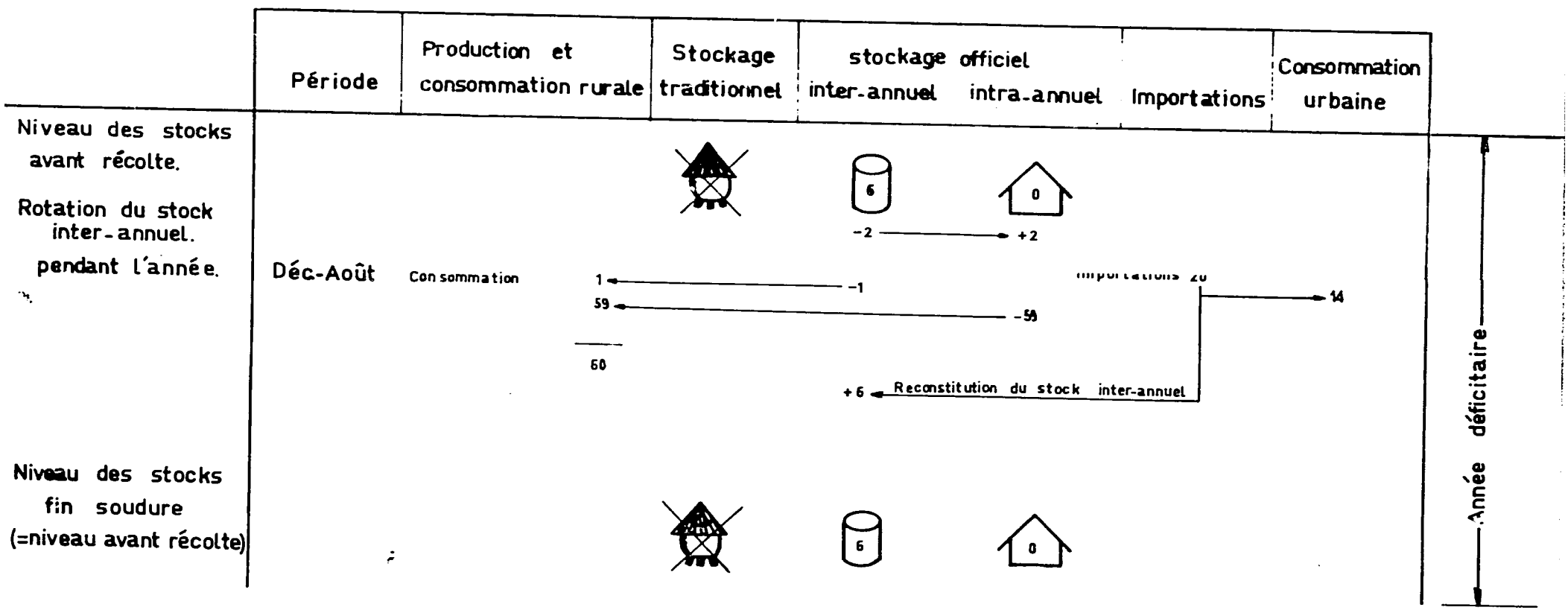
PORT	DESTINATION	COST OF TON DELIVERED ON SITE	DEEDLINES		CAPACITY OF TRANSPORTATION 1,000 t/month
			Minimum	Probable	
COTONOU	NIAMEY	17 000 F.CFA	3 days	10 days	10 to 20
DAKAR	BAMAKO	18 000 "	11 days	25 days	8 to 10
DOUALA	N'DJAMENA	40 000 "	24 days	60 days	6 to 9
ABIDJAN	OUAGADOUGOU	26 000 "	5 days	12 days	8 to 10
LOME	OUAGADOUGOU	24 000 "	6 days	15 days	5 to 7
LOME	NIAMEY	27 000 "	n d	n d	n d
ACCRA	OUAGADOUGOU	47 000 "	7 days	15 days	2 to 3

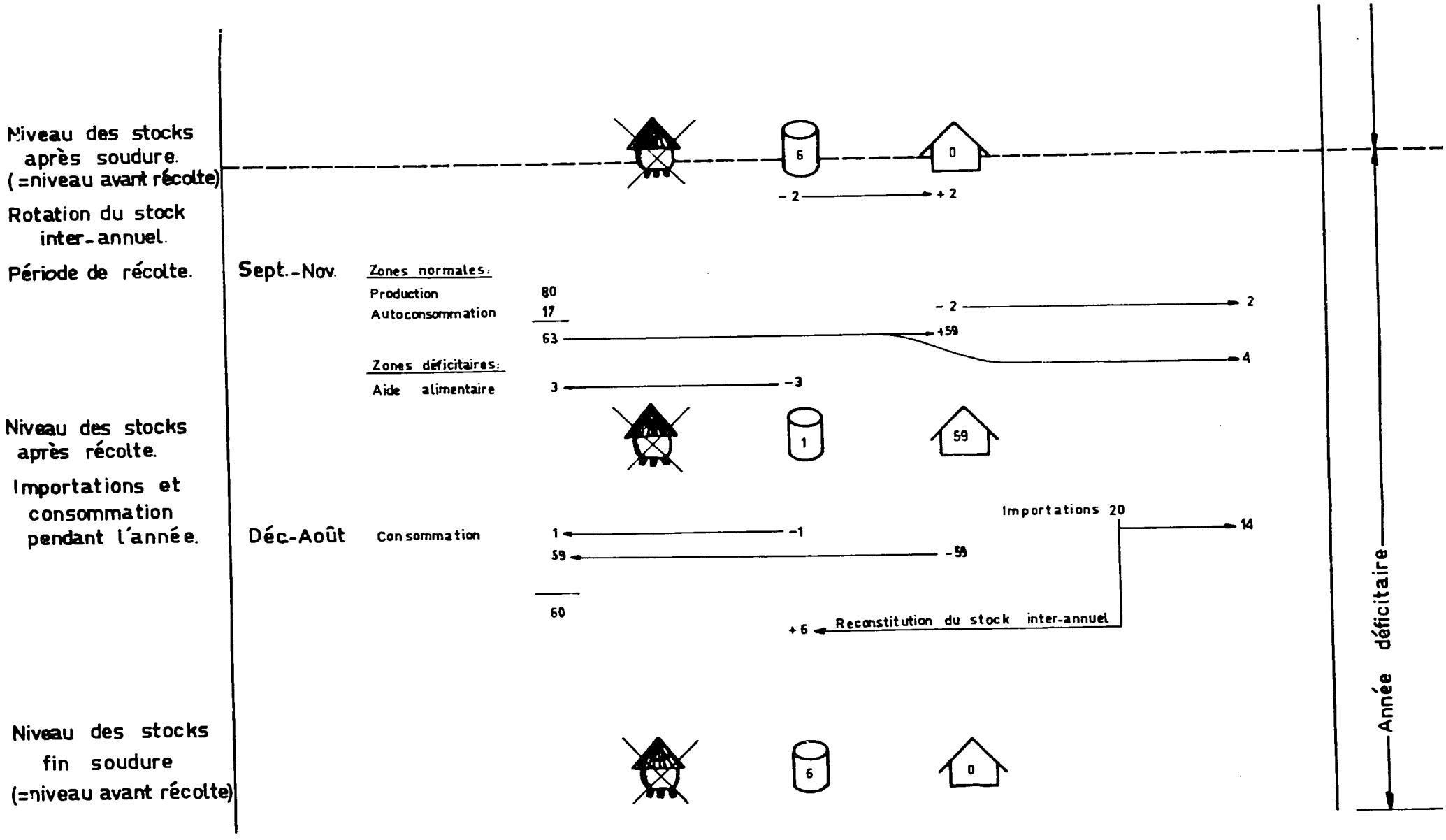
SOURCE : See port study, Tome III

n d : not determined

- ALTERNATIVE I_1 -

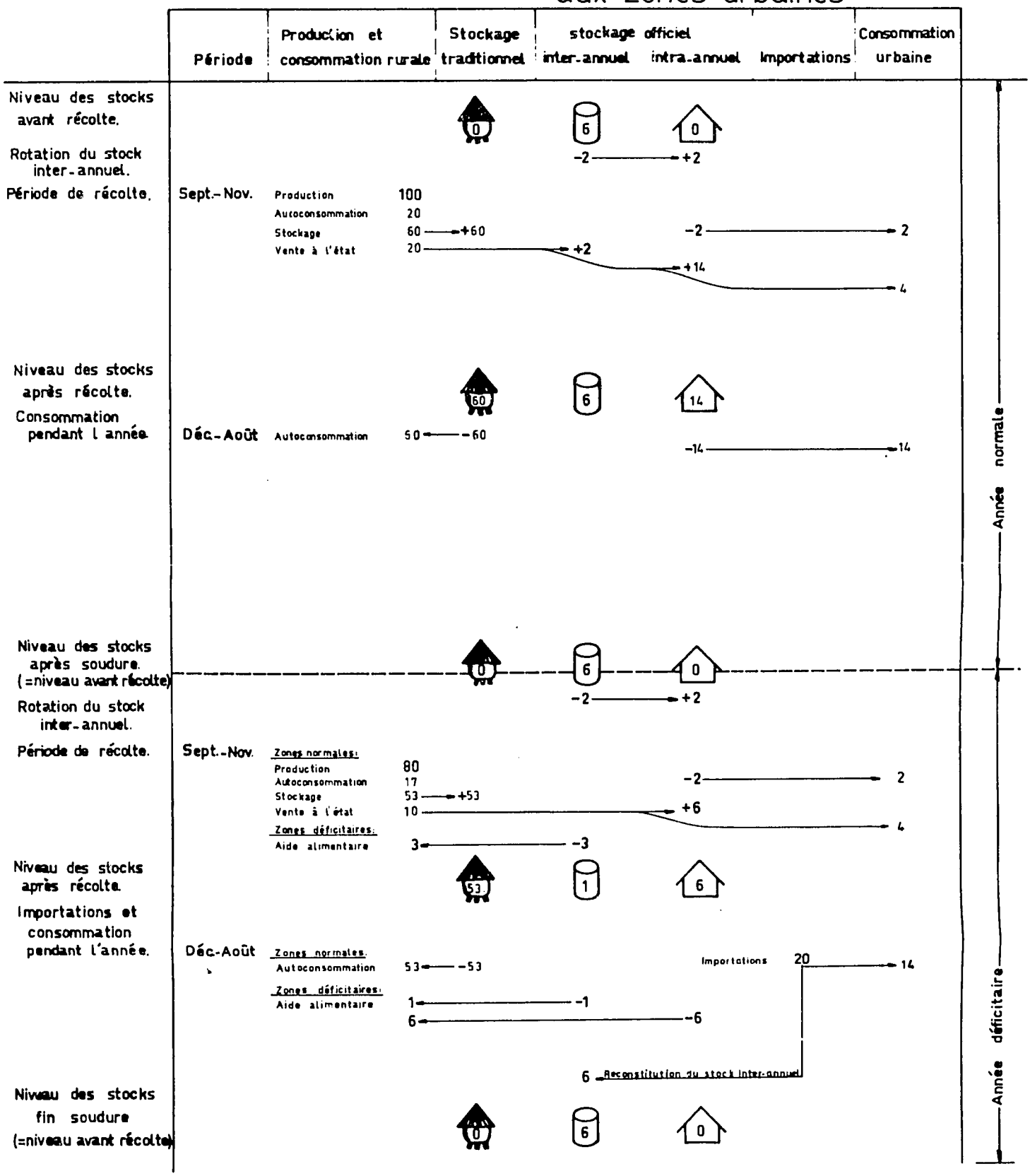
Stockage inter-annuel : Etatisation générale
Stockage intra-annuel : Etatisation générale




Niveau des stocks après soudure. (=niveau avant récolte)
Rotation du stock inter-annuel.
Période de récolte.
Sept.-Nov.
Zones normales:
Production
Autoconsommation
80
17
63
Zones déficitaires:
Aide alimentaire
3
Niveau des stocks après récolte.
Importations et consommation pendant l'année.
Déc-Août
Consommation
1
59
60
Importations 20
Reconstitution du stock inter-annuel
Niveau des stocks fin soudure (=niveau avant récolte)
6
0
-2
+2
-2
2
+59
4
-3
1
59
-1
-59
14
+6
6
0
Année déficitaire

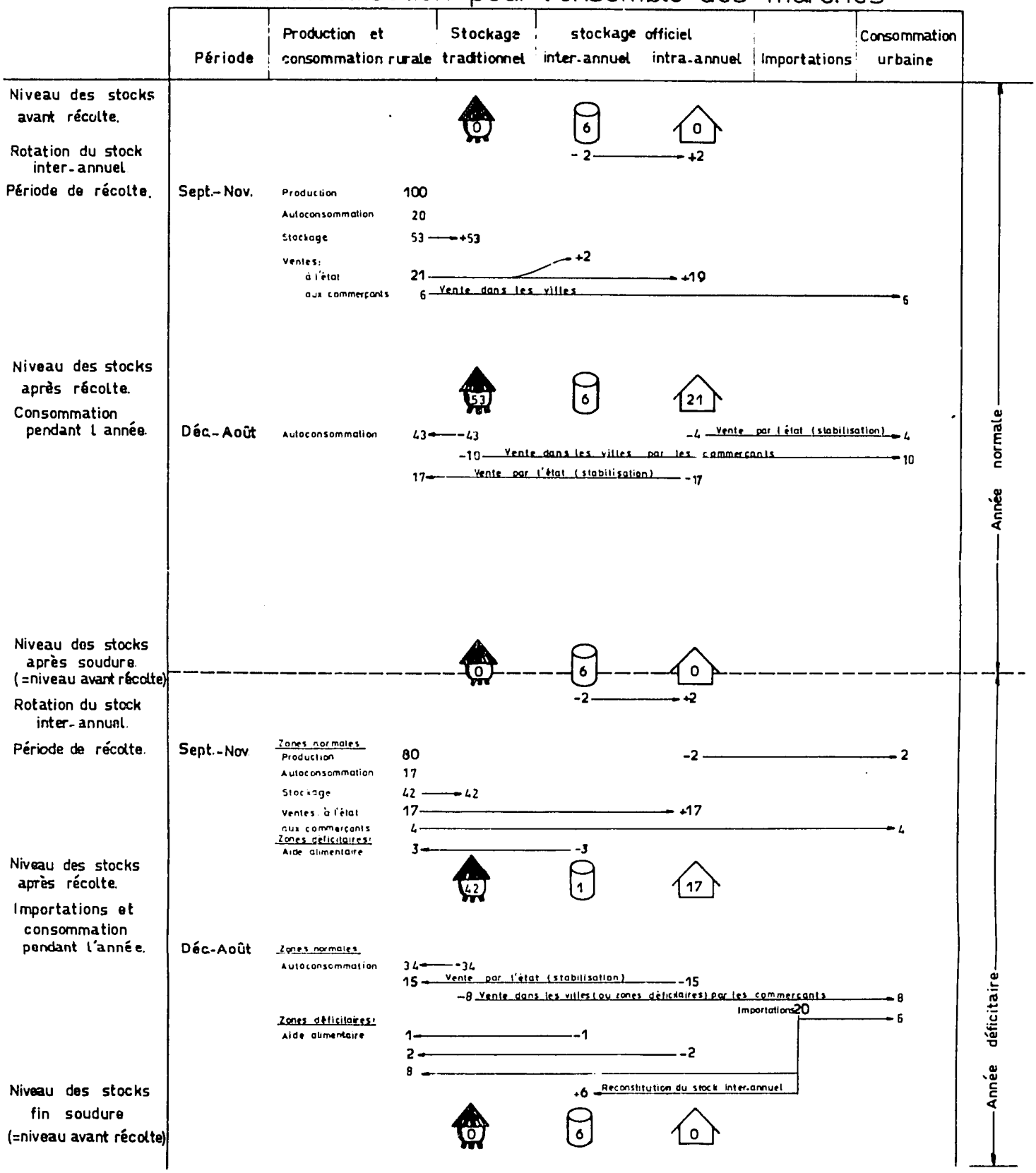
—ALTERNATIVE II_1—

Stockage inter-annuel : Etatisation générale
Stockage intra-annuel : Etatisation totale limitée aux zones urbaines



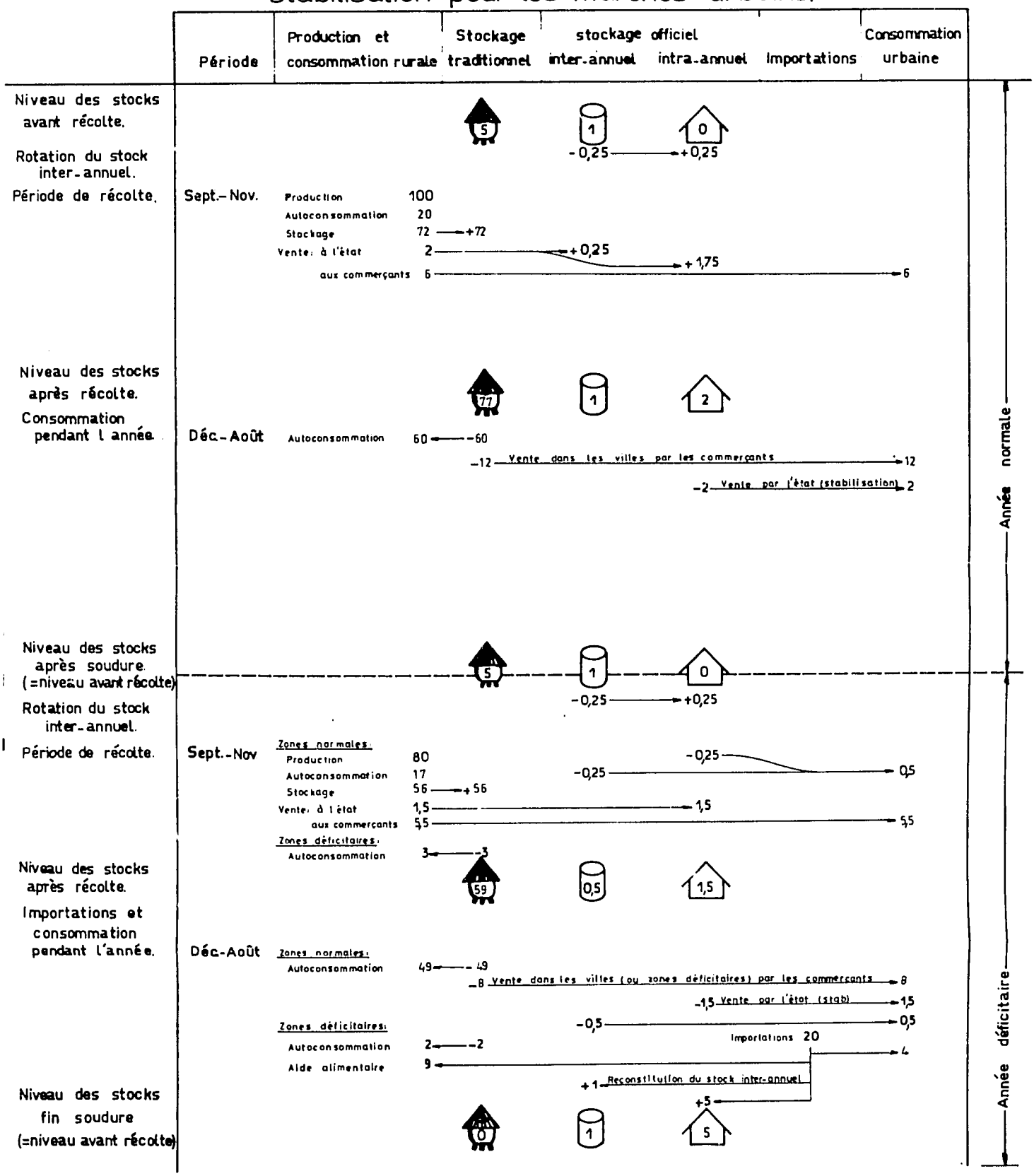
—ALTERNATIVE III1—

Stockage inter-annuel : Etatisation générale
Stockage intra annuel : Etatisation limitée à un stock de stabilisation pour l'ensemble des marchés



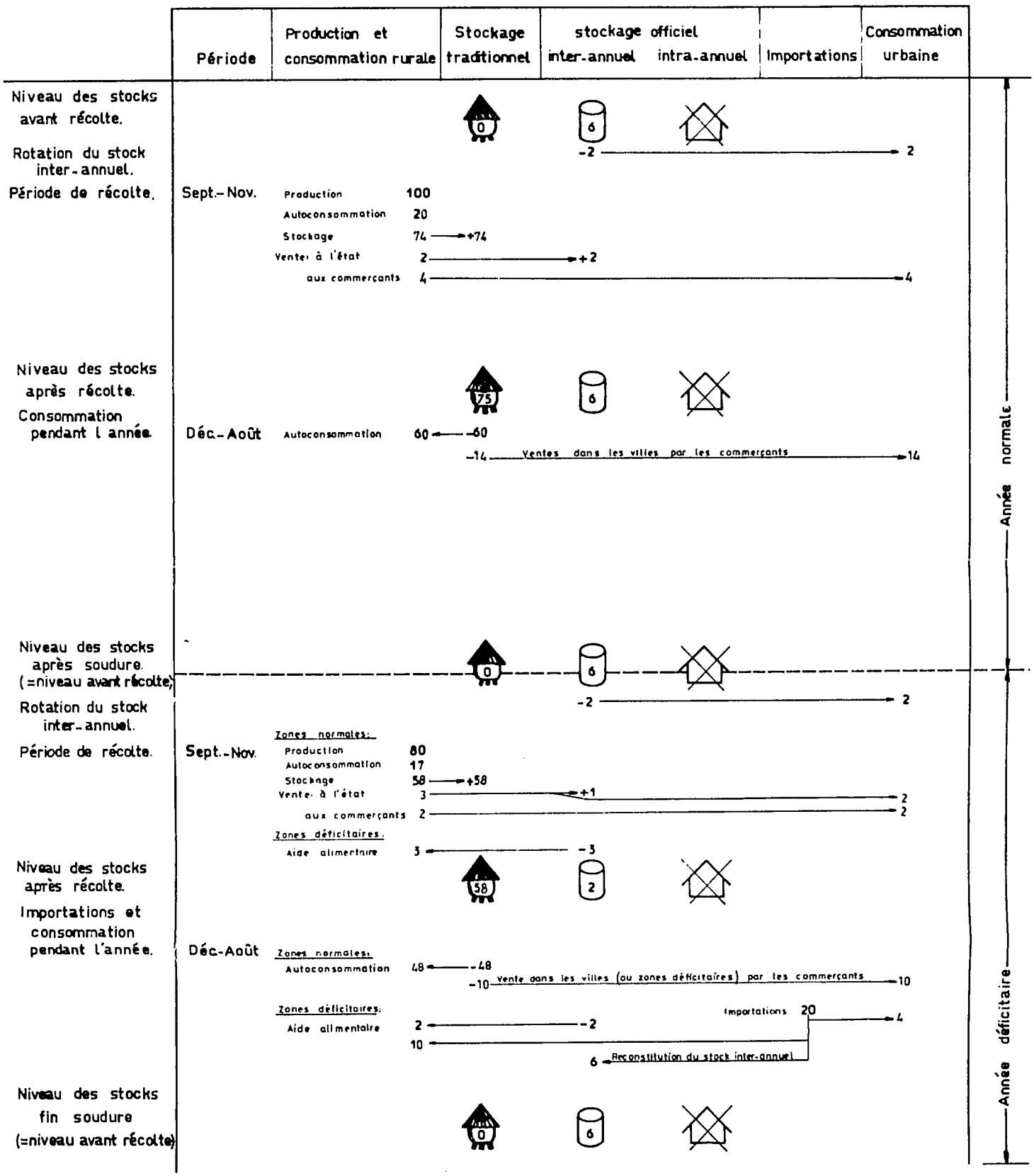
— ALTERNATIVE IV 2 —

Stockage inter-annuel : Etatisation limitée aux marchés urbai
Stockage intra-annuel : Etatisation limitée à un stock de stabilisation pour les marchés urbains.

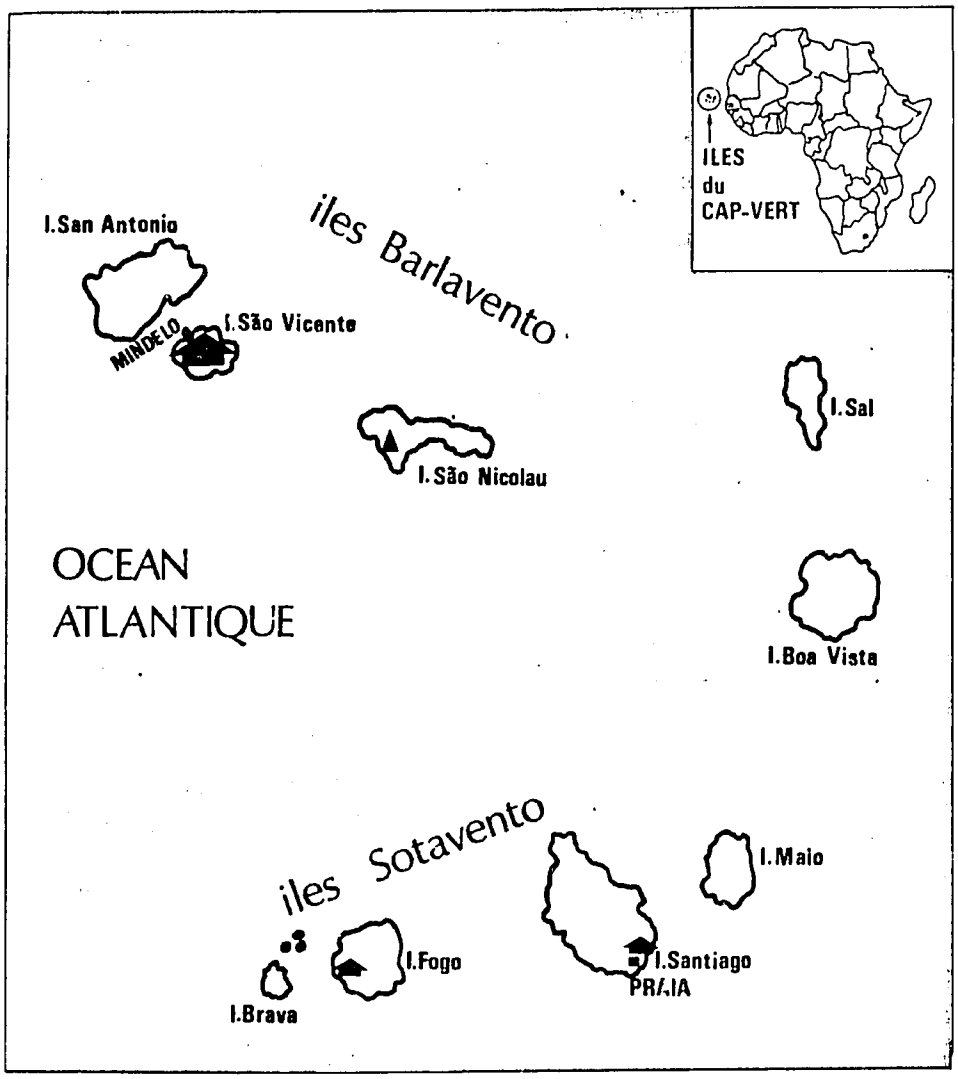


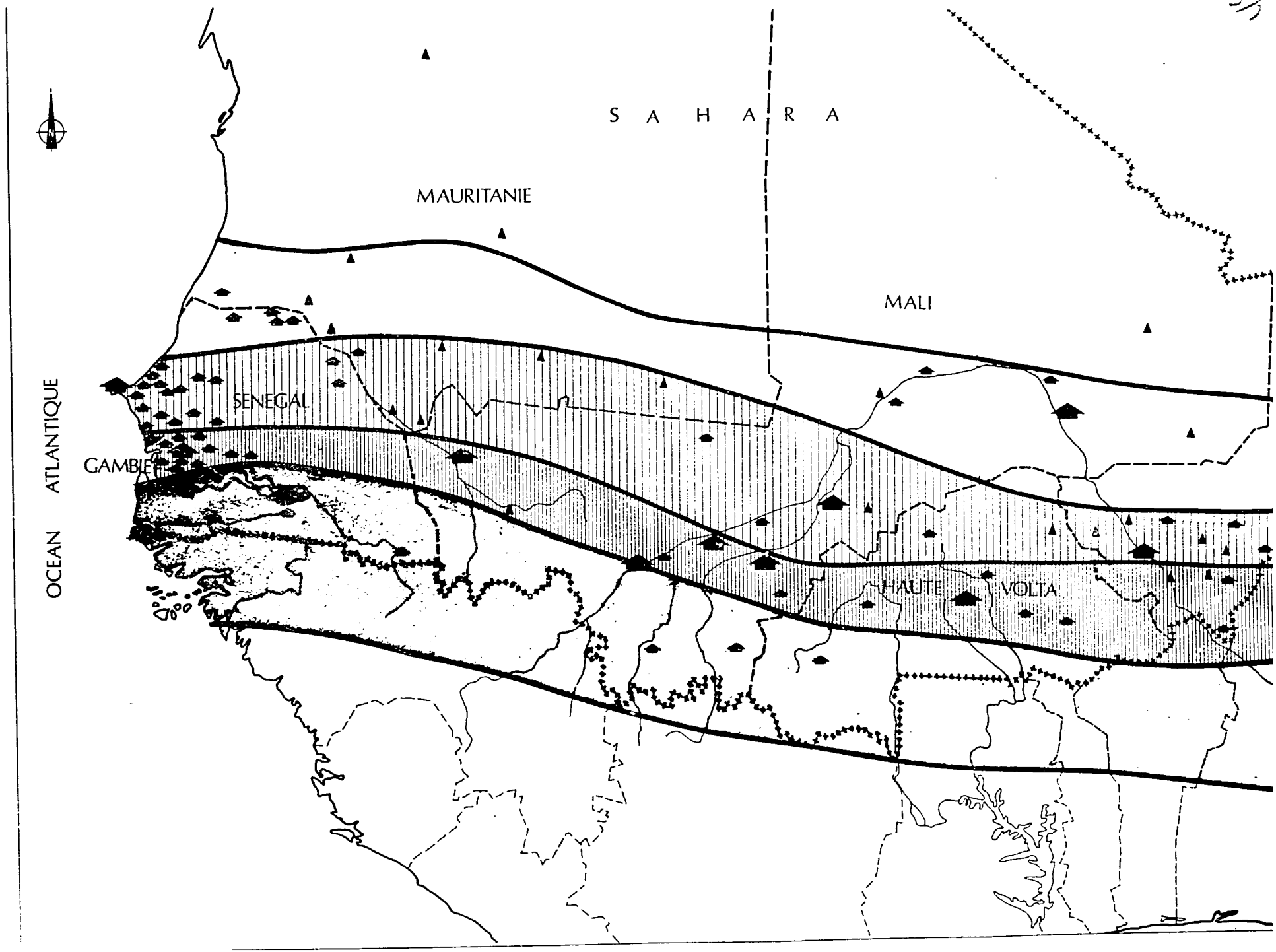
– ALTERNATIVE V₁ –

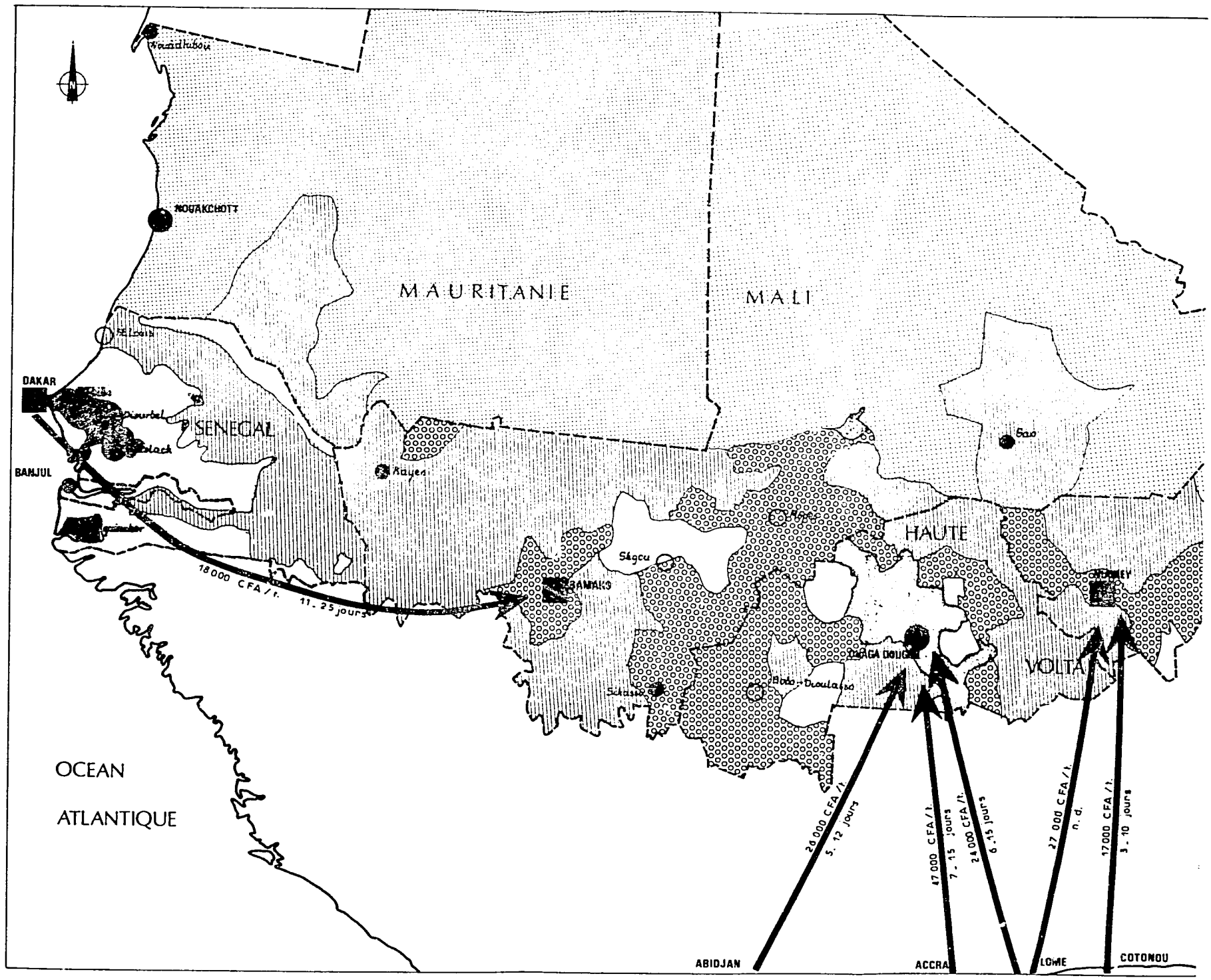
Stockage inter-annuel : Etatisation générale.
Stockage intra-annuel : Aucune étatisation.

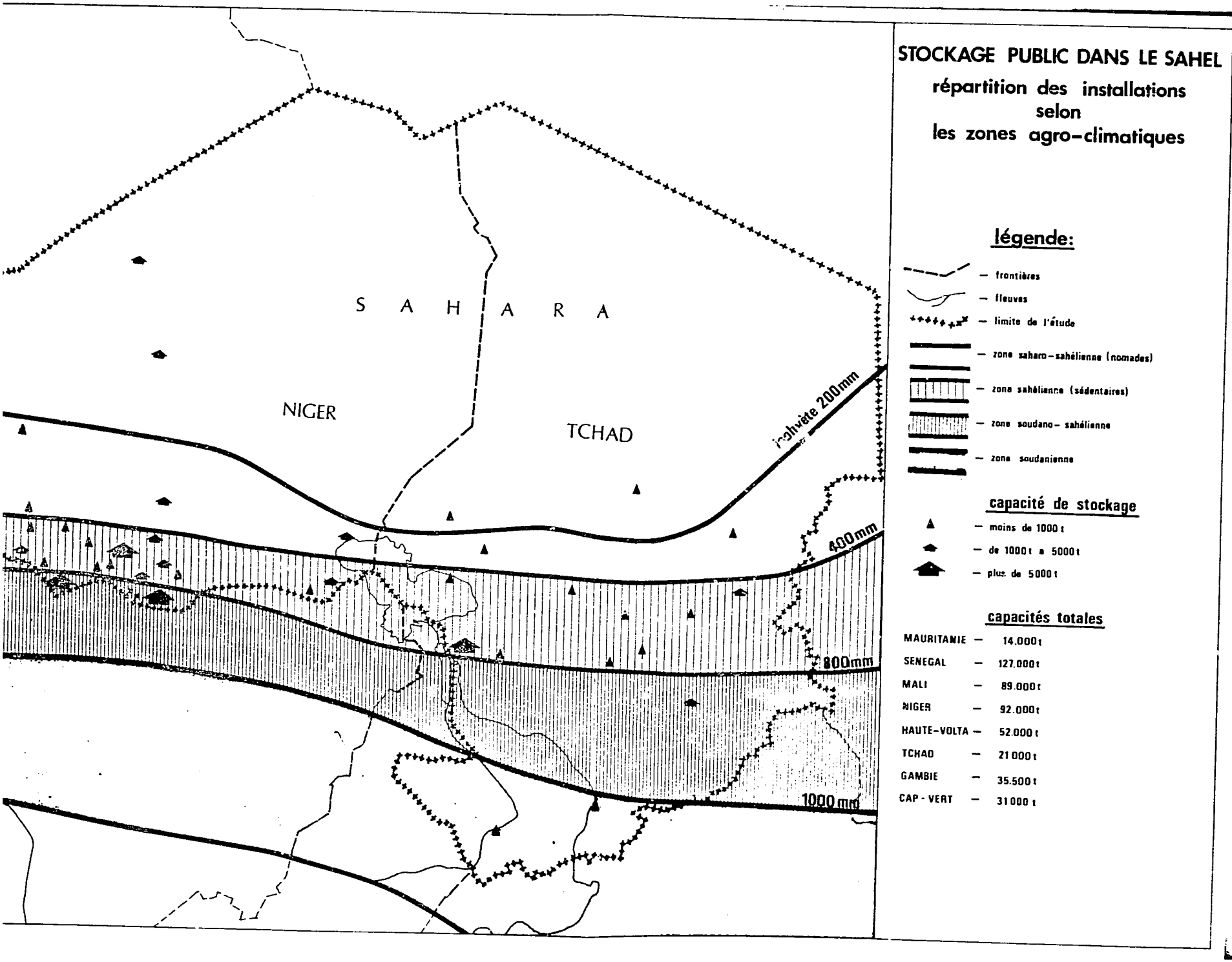


STOCKAGE PUBLIC DANS LES ILES DU CAP-VERT




S A H A R A
MAURITANIE
MALI
SENEGAL
GAMBIE
HAUTE VOLTA
OCEAN ATLANTIQUE


MAURITANIE
MALI
NOUAKCHOTT
DAKAR
SENEGAL
BANJUL
Kayes
Ségou
BAMAKO
Gao
HAUTE
VOLTA
OUAGA DOUGOU
Bobo-Dioulasso
OCEAN
ATLANTIQUE
18 000 CFA/t.
11 - 25 jours
20 000 CFA/t.
5 - 12 jours
17 000 CFA/t.
7 - 15 jours
24 000 CFA/t.
6 - 15 jours
27 000 CFA/t.
n. d.
17 000 CFA/t.
3 - 10 jours
ABIDJAN
ACCRA
LOME
COTONOU


STOCKAGE PUBLIC DANS LE SAHEL
répartition des installations
selon
les zones agro-climatiques
légende:
— frontières
— fleuves
— limite de l'étude
— zone saharo-sahélienne (nomades)
— zone sahélienne (sédentaires)
— zone soudano-sahélienne
— zone soudanienne
capacité de stockage
— moins de 1000 t
— de 1000 t à 5000 t
— plus de 5000 t
capacités totales
MAURITANIE — 14.000 t
SENEGAL — 127.000 t
MALI — 89.000 t
NIGER — 92.000 t
HAUTE-VOLTA — 52.000 t
TCHAD — 21.000 t
GAMBIE — 35.500 t
CAP-VERT — 31.000 t
SAHARA
NIGER
TCHAD
isohyète 200mm
400mm
800mm
1000mm