Staff Paper

ANALYSIS OF THE FOOD SITUATION
IN SENEGAL
EVOLUTION FROM 1974 TO 1985
AND PROJECTIONS

by

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Introduction

The food situation in Senegal is a multi-faceted topic which has been discussed in several recent documents (1). In this paper, we analyze the food situation in a food policy perspective. The approach used involves three steps:

1) to identify the key food policy issues faced by Senegal which the government must consider;

2) to marshal relevant facts from which we can draw insights about the issues previously identified;

3) to outline the type of research needed to improve our knowledge base and thus to improve our analysis of the food situation.

The analysis focuses on the cereals sector, reflecting the importance of cereals in Senegalese consumption (2).

The quality of the data available for this analysis is sometimes less than desirable, in particular regarding consumption. Therefore the general magnitudes of the data presented are more reliable than the specific numerical estimates.

1 - The key issues of food policy in Senegal

In its most basic formulation, the food policy issue in Senegal is to determine which agricultural products the country should produce, import, export and consume.

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(1) To mention a few: the 1980 FAO report on food security in Senegal, the 1984 Abt Associates report prepared for USAID on analysis of agricultural policy in Senegal, the 1985 FAO study on cereals policies and programs, and the 1986 CILSS/Club du Sahel study on cereals policy reforms in the Sahel, prepared by Elliot Berg Associates.

(2) According to surveys conducted by the "Organisme de Recherche sur l'Alimentation et la Nutrition en Afrique Noire" (ORANA), in 1978/81, annual per capita cereal consumption made up on average 57.8 % of total calories consumed and 50.3 % of total protein consumed in urban areas, and 60.3 % of the calories and 49.4 % of the protein consumed in rural areas (Secretariat Chargé de la Décentralisation (1984) p.278).

Since well before independence, Senegal has followed a strategy based on specialization in the production and the export of groundnut products, which pay for the import of Asian broken rice to feed its population. This strategy was questioned for the first time in 1977 in the Food Investment Plan published by the Ministry of Rural Development. This plan called for a voluntary policy of substitution of local cereals for imported cereals, but the policy was never put into effect.

More serious modification of the specialization strategy occurred in 1984 with the definition of a New Agricultural Policy, and in 1985 with the publication of the Seventh Plan of Development. In these documents, the government set a goal of 80 % food self-sufficiency by the year 2000, implying a shift of priority from industrial crops to cereal crops.

The two questions that one must ask are the following:

1) Is this objective realistic ?

2) Is this objective desirable ?

We will try to provide some answers to each of these questions.

2 - 80 % cereals self-sufficiency: is it realistic ?

To address this question, we first analyze the present cereals food balance sheet and its recent evolution from 1974 to 1985, and then examine projections to the year 2000.

A) The present cereals balance sheet and its recent evolution from 1974 to 1985

A1 - Evolution of the national cereals balance sheet from 1974 to 1985

a) The national balance sheet, all cereals (see graph 1)

First observation: The total cereals supply increases 20 % from 1.115 million tons in 1974/76 to 1.338 million in 1983/85 (see TAB-1A).

Second observation: National cereals production decreases 16.7 % from 751930 tons in 1974/76 to 626450 tons in 1983/85. Moreover, the share of national production in the total supply of cereals, i.e., the self-sufficiency level, decreases from 67.2 % in 1974/76 to 46.6 % in 1983/85 (see TAB 1-B).

Third observation: The absolute value and the share of the national production fluctuate a lot from year to year in response to rainfall (see graph 2). This reflects the predominance of rainfed agriculture in Senegal.

Fourth observation: Commercial imports of cereals increase 69.8 % from 323930 tons in 1974/76 to 550020 tons in 1983/85. The share of commercial imports in the total supply of cereals increases from 29.1 % in 1974/76 to 41.2 % in 1983/85 (see TAB 1-B).

Fifth observation: Food aid in the form of cereals increases 315 % from 38990 tons in 1974/76 to 161980 tons in 1983/85. The share of food aid in the total supply of cereals increases from 3.7 % in 1974/76 to 12.2 % in 1983/85 (see TAB 1-B).

Sixth observation: The total supply of cereals per capita declines only slightly during the period, from 225.3 kilos in 1974/76 to 209.5 kilos in 1983/85 (see TAB 1-E and graph 3). It is always above the 200 kilo norm considered as necessary by the FAO to satisfy per capita food needs in Sahelian countries. The increase in the volume of commercial imports and food aid made it possible to maintain the consumption of cereals by the Senegalese population at a satisfactory level (1).

b) The national balance sheet by cereal

First observation: Millet/sorghum has the biggest share in the total supply of cereals, but it decreases from 60.4 % in 1974/76 to 47.3 % in 1983/85. The share of wheat remains about the same, going from 10 % in 1974/76 to 11 % in 1983/85. However, the share of rice increases from 23 % to 33.2 % and that of maize too, from 6.7 % to 8.5 % during the same period (see TAB 1-C).

Second observation: The share of millet/sorghum in national cereals production is by far the largest, but it decreases from 85.2 % in 1974/76 to 74.6 % in 1983/85, reflecting the decrease in the average level of production from 640900 tons to 469550 tons during that period (see TAB 1-A and 1-C, and graph 4).

The share of rice in national production increases slightly from 9.3 % in 1974/76 to 12.5 % in 1983/85, the production level going from 70530 tons to 76500 tons during the same period (see TAB 1-A and 1-C, and graph 4).

The share of maize in national production increases significantly from 5.5 % in 1974/76 to 12.9 % in 1983/85, the production level going from 40470 tons to 80400 tons (see TAB 1-C and graph 4).

Third observation: Rice is by far the most important imported cereal, followed by wheat (respectively 63.4 % and 24.4 % of imports from 1974 to 1985). The share of rice in the commercial imports of cereals fluctuates from year to year without any clear trend. However, the share of wheat decreases from 33.9 % in 1974/76 to 19.8 % in 1983/85. The share of millet/sorghum fluctuates a lot from year to year and represents on average 9 % of commercial imports of cereals. The share of maize is marginal (3.2 %)(see TAB 1-C and graph 6).

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(1) At least compared to the FAO norm measured in kilos.

Fourth observation: In food aid received by Senegal, millet/sorghum is the most important cereal (49 % of food aid from 1974 to 1985), followed by wheat (21.2 %), maize (15.3 %) and rice (14.6 %). The respective shares of the different products fluctuate a lot from year to year.

A2 - The regional cereals balance sheets for 1983/85 (1)

a) The regional balance sheets, all cereals

First observation: The cereals balance sheet varies significantly from one region to the other (2), even though all regions experience an overall deficit (cereals production less than consumption; see map 2 and TAB III-B). In general, the farther north in the country, the smaller the share of production and conversely the higher the shares of commercial imports and food aid (see TAB II-B). Three specific sub-groups should be noted.

First, there is a group of high production areas such as Casamance, Eastern Senegal and Sine-Saloum, in which on average production makes up 69 % of the total supply of cereals, commercial imports 23.4 %, and food aid 7.7 % (see TAB II-B).

Second comes an intermediate group including the regions of Thiès and Diourbel where on average production makes up 45.3 % of the total cereals supply, commercial imports 41.7 % and food aid 13 % (see TAB II-B).

Third, the Louga zone located further to the north experiences a large deficit; production makes up 2.4 % of the total supply of cereals against 40.4 % for commercial imports and 57.2 % for food aid (see TAB II-B).

Second observation: Two regions exhibit special features: the Senegal River Basin and the Cap Vert region. The development of irrigated cultivation in the Senegal River Basin makes it possible for production to represent 53.1 % of the total supply of cereals in that zone compared to 26.2 % for commercial imports and 20.6 % for food aid (see TAB II-B).

The Cap-Vert region is a predominantly urban area whose major supply source is commercial imports (99.7 % of the total supply of

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(1) The regional cereals balance sheet is obtained by calculating the difference between the estimated cereals consumption and the cereals production in that region. Regional consumption is the sum of both urban and rural consumption. The latter is calculated by multiplying the per capita consumption as estimated by FAO (see TAB III-A2) by the corresponding rural population.

(2) The names of regions are indicated on map 1.

cereals; see TAB II-B). Cereals production is essentially zero. Food aid is also very low in that region (2.3 % of total cereals supply).

b) The regional balance sheets by cereal

First observation: The shares of each cereal in regional cereals supply (1) vary significantly from region to region. The supply in the Groundnut Basin regions (Diourbel, Thiès, Sine-Saloum) consists mainly of millet/sorghum (on average 66.4 %) which is nearly all locally produced.

Millet/sorghum is also important for Casamance and Eastern Senegal (45.2 % on average), but these regions also produce other cereals such as maize in Eastern Senegal (36.3 % of the regional supply) and rice in Casamance (32.1 %). The Louga region produces mainly millet/sorghum (41.2 % of the regional supply), but falls short and must receive commercial imports of rice (28.1 %) and wheat food aid (30.7 %). The supply in the Senegal River Basin consists mainly of rice (56.6 %) which is nearly all locally produced on irrigated perimeters. The supply in the Cap Vert region consists mainly of rice (70 % of the total supply), nearly all imported (see TAB II-C and graph 7).

Second observation: Regarding millet/sorghum, only one region (Sine-Saloum) exhibits a large surplus. Another region (Casamance) shows a small surplus. Eastern Senegal, Cap Vert and the center of the Groundnut Basin (Diourbel, Thiès) are small deficit areas. The north of Senegal (Senegal River Basin and Louga) is a large deficit area (see map 3 and TAB III-B).

Third observation: Regarding maize, only one region (Casamance) shows a large surplus. Another region (Eastern Senegal) exhibits a small surplus. All other regions have small deficits (see map 4 and TAB III-B).

Fourth observation: Regarding wheat, the biggest deficit area is Cap Vert. The northern part of the country (Senegal River Basin, Louga, Diourbel, Thiès) shows a large deficit. The southern part of the country (Sine-Saloum, Eastern Senegal, Casamance) exhibits a small deficit (see map 5 and TAB III-B).

Fifth observation: Regarding rice, the Senegal River Basin is the only region that shows a small surplus. Eastern Senegal exhibits a

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(1) Regional cereals supply is calculated as the sum of regional production, commercial imports, and food aid sent to that region. Since we do not take into account interregional cereal transfers given the lack of data, this estimate of regional supply may be an underestimate of the amount available for regional consumption. However, the estimate does provides insights into the relative importance of each cereal in each region.

small deficit. All other regions are large deficit areas, in particular the Cap Vert region (see map 6 and TAB III-B).

A3 - The farm-level cereals balance sheets

First observation: The cereals balance varies also from farm to farm in any given region. Even in high producing areas such as Sine-Saloum or Casamance, a number of farms do not succeed in achieving self-sufficiency in cereals (see TAB IV-A).

Second observation: Most farms experiencing a cereals deficit (production less than consumption) are small. Apart from the constraint on land available for cultivation, the decisions of small farmers to grow industrial crops on part of their land and to sell part of the cereals they produce also contribute to their cereals deficit.

A study by SODEVA (1) in 1981/82 found that the percentage of cereals produced that was marketed was 8 % for the group of farms producing less than 200 kilos per capita annually, 6 % for the group producing between 200 and 300 kilos and 8 % for the group producing between 300 and 450 kilos. This surprising phenomenon can be explained by the necessity for all families, including the poorest ones, to have enough income to buy basic consumer goods such as sugar, tea, and cooking oil, and to satisfy their social and religious obligations.

To conclude this analysis of the present cereals balance sheet and its recent evolution, it is clear that the cereals deficit has increased during the last ten years despite variations according to region, type of cereal, and type of farm. **The self-sufficiency level decreased from 67 % in 1974/76 to 47 % in 1983/85.** Thus the country has been moving away from the 80 % objective set by the government for the year 2000. Is it possible to correct that trend to meet the government's objective ? This question is analyzed in the next part.

B) Projected cereals balance sheets

First observation: Projections of the cereals balance sheet depend of course on the assumptions made. Projections of cereals production depend on the assumed growth of cultivated areas and yields. The predicted availability of credit, agricultural inputs (seeds, fertilizers), and agricultural equipment, and the predicted relative prices of inputs and outputs, will also influence the projections. Regarding irrigated cultivation, assumptions about the increase in

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(1) The "Société de Développement et de Vulgarisation Agricole" (SODEVA) is a parastatal in charge of extension in the Groundnut Basin.

irrigated area and the coefficient of cropping intensity (1) play a crucial role.

On the demand side, assumptions about population growth and per capita cereals demand are critical. In general, the planned evolution of the institutional environment will have an important inluence on the future cereals balance sheet, in particular the role of the state and of the private sector in the production and the marketing of agricultural inputs and outputs.

Second observation: The first approach to making projections is to start from estimated future cereal needs and examine what this implies for production taking as a constraint the government's objective of 80 % cereal self-sufficiency by the year 2000. This is the approach used by FAO (2) (see TAB V-A). The advantage of this method is to show clearly the infeasibility of the self-sufficiency objective, in light of the heroic assumptions required to achieve it.

Apart from very optimistic assumptions about the intensification of rainfed agriculture (3), the most unrealistic assumptions are those made for the development of irrigated agriculture. The FAO estimates that the government's objective can be reached with an annual increase of 3800 hectares of new irrigated perimeters, a coefficient of cropping intensity of 1.8 and yields of 6 tons of paddy rice per hectare. At present, however, only about 2800 hectares of new irrigated perimeters are created every year. Moreover, a number of irrigated perimeters are not fully cultivated and must be rehabilitated. Therefore the real annual increase in irrigated zones is around 2500 hectares, i.e. below the planned 3800 hectares target.

The coefficient of cropping intensity on irrigated perimeters is presently around 1, i.e., there is nearly no double cropping. Perimeters that have two cropping seasons per year (for example, rice in the rainy season and tomato in the cold dry season) do not represent true double cropping since each crop is grown on separate plots.

The completion of the Manantali dam in 1987 will make the generalization of double cropping theoretically possible. It remains

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(1) The coefficient of cropping intensity measures the extent of double cropping. For example, a coefficient of 1.4 means that 40 % of the irrigated zone grows two crops per year, and 60 % one crop per year.

(2) FAO makes projections only until 1995 and therefore uses a cereals self-sufficiency objective of 75 % by this date.

(3) Rainfed millet/sorghum production must go up 29.5 % on average, from 562770 tons for the period 1974/85 to 729000 tons in 1995. The production of rainfed maize must go up 292 %, from 80400 tons for the period 1983/85 to 315000 tons in 1995.

to be seen if farmers are ready to make the investment in money and time to double crop if single cropping can satisfy most of their food and cash needs. The realism of a coefficient of cropping intensity of 1.8 thus appears questionable.

Finally, the present average rice yield on irrigated perimeters is around 4.7 tons of paddy per hectare. The FAO assumption of an average yield of 6 tons seems a bit optimistic.

In short, the assumptions necessary to meet the government's cereals self-sufficiency objective seem unrealistic, and thus the 80 % self-sufficiency objective itself appears unattainable.

Third observation: Another approach to forecasting the cereals balance sheet is to project production using realistic assumptions and then compare it with projected cereals demand. This approach is adopted by the Abt Associates study (1) prepared for USAID, and by the "Schéma National d'Aménagement du Territoire" (see TAB V-B and V-C). **Both studies come to the same conclusion: even with optimistic assumptions about production (2), the level of cereals and grain self sufficiency will probably stay unchanged from 1983/85 to 1995 (see graph 8).**

Fourth observation: The only apparent hope for improving the level of food self sufficiency in the very long run is to reduce population growth. The birth control issue is a complex and touchy one the study of which goes beyond the scope of this paper. However, the following figures sugest the importance of an in-depth analysis of this topic. A study by the research group RAPID (3) forecasts in 2030 a population of 30 million people if current trends continue (7 children per woman), 20 million people if the birth rate is slightly reduced (5 children per woman by the year 2000), 15 million people if the birth rate is strongly reduced (3 children per woman by the year 2010; see graph 9).

In the past, the government's traditional approach to reducing the cereals deficit was to try to increase national cereals production. The government realized recently that more production was not enough, and that marketing system performance also had to be improved in order to handle the extra agricultural inputs and outputs. This consideration and other factors have led the government to begin liberalizing cereals marketing. Recognizing also the importance of consumer preferences, the government has launched a program of millet and maize processing to make these locally produced cereals more competitive with imported cereals.

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(1) The Abt Associates study makes projections for the grain balance sheet, which includes cowpeas.

(2) See tables TAB V-B and V-C for the detailed assumptions.

(3) RAPID, (1984). NB: a revised version of this study is nearly complete.

All these policies go in the right direction, but one must wonder whether they will be enough to reach the stated self-sufficiency objective, without complementary policies to reduce the rate of population growth and thus the demand for cereals over the long run.

To conclude this second part, the analysis of the cereals balance from 1974 to 1985, and projections of the cereals balance sheet to 2000, both suggest that the objective of 80 % self-sufficiency by the year 2000 will be virtually impossible to achieve.

3 - 80 % cereals self-sufficiency: is it desirable ?

To answer this second question is even more difficult than to answer the first. It involves not just economic aspects, but also political and social aspects. There are several key concepts that should afford us some insights into this issue.

A) First key concept: comparative advantage

The economic theory of international trade is based on the notion of comparative advantage. To simplify, a country P has a comparative advantage in the production of a good X when it is more profitable for P to produce X and to sell it to the rest of the world while importing another good Y than to produce both X and Y. In order to obtain an optimal allocation of resources, each country should specialize in the production and export of goods for which it has a comparative advantage. Conversely, each country will import the goods for which its production is relatively less competitive.

Direct application of this theory to Senegal has tended to show that Senegal does not have a comparative advantage in rice production (1). Depending on the assumptions used, the cost of rice produced in the Senegal River Basin and processed and transported to Dakar is estimated to be in a range of 160-250 CFAF per kilo. The CAF price of imported Asian broken rice in Dakar varies between 90 and 100 CFAF per kilo. For groundnuts, on the other hand, local costs of production are much more competitive with world prices. It therefore makes sense to produce and export groundnuts and to import rice (2).

While this theory must remain at the heart of all economic analyses of production activities in Senegal, one must be careful not to apply it blindly. First, the theory assumes an accurate estimation of national costs of production and of the world price for the product under consideration. This is far from easy, however.

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(1) For a detailed analysis of this question, see Pearson, Humphreys and Stryker (1981), Jabara (1979), Craven (1982) and Tuluy (1979). These studies all use data for the mid-1970's.

(2) Jabara's study (1979) showed that under certain conditions local production of rice (hence a move toward self-sufficiency) was more economic when uncertainty was considered than when it was not.

Rainfed cultivation in Senegal does not use inputs (in particular fertilizers) and agricultural equipment intensively. The main factor of production is labor. As a result, the cost of production of cereals under rainfed conditions depends significantly on the value given to labor.

Agricultural wage labor is not extensively used in Senegal. This reduces the validity of the agricultural wage as the basis for valuing labor. Another method is to value labor according to the average net margin per man-day of on-farm labor, calculated from crop budgets (1). Whatever the method adopted, one must be cautious in the analysis of costs of production for rainfed agriculture.

The cost of production in irrigated agriculture is also hard to estimate. Should the initial investment required to create the irrigated infrastructure as well as the cost of foreign technical assistance be included in the cost of production ? Finding an answer to that question is not easy and falls outside the scope of this paper. Let us just point out that, given their magnitude, the inclusion or the exclusion of these costs will influence the total cost of production significantly. Therefore the cost of irrigated cultivation is also subject to alternative estimates.

One must also be cautious when selecting world prices for the analysis. First, these prices fluctuate over time and it is not always easy to know which reference level to use (see graphs 10-1 to 10-2). Second, the economic significance of world prices can sometimes be questioned, in particular for cereals. The United States and the European Community compete vigorously in the world cereals market, using direct and indirect subsidies to lure potential buyers. As a result, the export price falls well below the real cost of production in Europe or in the United States.

This benefits Senegal in the short run since it lowers the opportunity cost of obtaining cereals. However, a comparative advantage analysis should take a longer-run view, asking whether current world prices are likely to be maintained over a significant period. If this is not certain, then local production will be more attractive relative to imports.

In this regard, the world price of broken rice possesses some special characteristics. Only 4 % of the world production of rice is traded in the world market (2). Therefore the world price of rice is set in a residual market that does not necessarily reflect the costs of production in Asian countries.

This phenomenon is all the more important since Senegal imports 100 % broken rice, which is a by-product of paddy rice processing.

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(1) After deduction of all other costs than family labor cost.

(2) Siamwalla et Haykin (1983), p. 13.

The world market for broken rice is even narrower than the market for whole-grain rice. The world price of imported broken rice may then be interpreted as the opportunity cost of rice produced in Senegal, at least in the short run, but it may not be representative of the costs of production in Asian countries.

B) Second key concept: food security

Food security can be defined as the ability of a country, a region or a family to assure to its members, on a continuous basis, a nutritionally adequate supply of food. This definition has two implications.

First, it is clear that food security does not necessarily imply food self-sufficiency. In the past, these two concepts have often been used interchangeably, yet it is important to distinguish between them. Food security can be achieved by a mix of local production and commercial imports.

Second, the definition also implies that food security has different meanings for different people, in particular for the government and for the farmer.

B1 - Food security for the government

From a macro perspective, there are at least four aspects of food security likely to be important to the government of Senegal:

i) The government does not want to depend on other countries to feed its population. This political objective of national independence favors a high level of food self-sufficiency. No country in the world is totally food self-sufficient; many try to keep a high level of food self-sufficiency.

This objective is a valid one. At the same time, it is useful to evaluate the economic costs associated with different levels of food self-sufficiency. A study is underway at the "Bureau d'Analyses Macro-Economiques" (BAME) of the "Institut Sénégalais de Recherches Agricoles" (ISRA) to address this issue (1). This study is intended to contribute to the achievement of food security by evaluating alternative food strategies (including those enunciated by the government of Senegal) according to various criteria including the economic costs associated with each strategy.

ii) The government must take into account the importance of agriculture for Senegal as a source of employment and of income. In 1980, 77 % of the active population was employed in agriculture. Agricultural activities play a critical role in food security through the production of food crops which are mainly consumed on the farm and through cash crops that generate rural income used partly to buy extra food. Even if Senegalese agriculture turns out to be not very

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(1) See Martin, 1986, for a detailed description of the study.

competitive on the world market, the government must foster its growth to assure the food security of a large part of the population.

iii) The government must implement a regional land management policy. The importance of such a policy is obvious for the Senegal River Basin. The only hope for this region which is hurt by severe climatic conditions lies in the development of irrigated agriculture. Even if irrigated cultivation is not economically efficient given present conditions in the world cereals market, the government may feel that irrigation development is justified by the social and political necessity of assuring food security in that region, as well as contributing to national food security.

iv) The government may want to minimize fluctations in the cost of the food bill. These fluctuations are caused by price variations and quantity variations. While most domestic prices for agricultural products are set by the government, world prices experience important fluctuations (see graphs 11-1 and 11-2). To maintain domestic prices at a constant level, the state must make up the difference between the domestic price and the world price, through taxes or subsidies.

Regarding quantities, the main source of uncertainty comes from domestic crop yields that fluctuate from year to year.

In reducing the impact of this uncertainty, the government faces a dilemma in terms of food policy: 1) variations in world prices and in yields of export crops argue for a greater level of food self-sufficiency; yet, 2) variations in cereals yields argue for a lower level of food self-sufficiency.

Which type of variation is more significant? If we use the coefficient of variation (CV) to compare the variability of world prices and of domestic yields from 1970 to 1984/85, we obtain the following relationships (see TAB VI-A and VI-B and graphs 10 and 11):

- The average CV's (1) of world prices denominated in CFA Francs are greater than the CV's for yields, respectively 0.4 and 0.23.

- The CV's of world prices and domestic yields (at the national level) vary relatively little from product to product. The range of coefficient values for world prices in CFA Francs goes from 0.31 for groundnut meal to 0.42 to groundnut oil. The range of coefficient values for domestic yields goes from 0.19 for cotton to 0.26 for groundnut and paddy rice (2).

- The CV's of domestic yields by product are higher at the regional than at the national level. Also, they are generally higher in northern regions (Louga, Diourbel) than in southern regions (Casamance and Eastern Senegal), where rainfall is less erratic.

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(1) The coefficient of variation is defined as the standard deviation divided by the mean of a time series.

(2) Based on official yield statistics.

In summary, this rough analysis of year-to-year variability, which shows that world prices vary more than domestic yields, tends to favor a high rather than a low level of food self-sufficiency in Senegal.

B2 - Food security for the farmer

From the Senegalese farmer's perspective, food security is likely to involve questions analogous to those at the macro level, concerning the appropriate degree of self-sufficiency in production.

i) The farm household head is responsible for assuring that the food needs of his family are met. This obligation will dictate the farming strategy. The farmer will first plant short-cycle cereals in the home gardens to make sure there is something to eat during the hungry season. He will also try to produce enough cereals to meet a large share of his family needs.

In many cases, the farmer may be unable to produce all the family's food needs, given limited land, labor, or equipment. Many farmers therefore allocate some area to cash crops such as groundnuts or cotton, which can finance food purchases or other cash expenses. Nonetheless, covering the bulk of family food needs through own production remains an important goal of most farmers (1).

ii) The farmer may also want to minimize his income fluctuations. The implications of this objective for the desired food self-sufficiency level are not clear. An often heard argument is that the farmer will favor traditional cash crops (groundnut, cotton) whose prices are effectively guaranteed by the government. The farmer would not cultivate cereals for sale, in particular millet/sorghum, because their price on the market fluctuates too much.

This argument is debateable. In fact, in an uncertain climatic environment in which yields fluctuate from year to year, maintaining a fixed price directly transforms yield variations into income variations. In contrast, fluctuating prices contribute to stabilizing income by counterbalancing yield fluctuations. Hence, given our current knowledge about farmer behavior, it is not clear whether the farmer will favor industrial crops or cereal crops to minimize his income variations.

C) Third key concept: food habits

Food habits constrain food policy options in the short to the medium run. In the long run, one can expect food preferences to be open to change.

This issue arises most importantly for rice. National production amounted to 76500 tons of processed rice in 1983/85, i.e., 17 % of the total rice supply (443530 tons). Even optimistic assumptions on

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(1) For example, see Kelly, 1986.

the development of irrigated rice cultivation lead to projections for rice production of only 250000 to 350000 tons of broken rice in the year 2000. However, projecting current trends in rice consumption gives a demand of 700000 to 900000 tons (1). Quite obviously, the level of rice self-sufficiency is going to remain low (between 28 % and 50 %).

The government is very hopeful about the policy of processing local cereals (millet/sorghum and maize) into easy-to-use products which can compete with broken rice. This policy is commendable, but it seems unlikely that it will have a major impact on food preferences by the year 2000.

The preference for rice seems well-established in urban areas, in particular in Dakar. Rice is presently consumed by the quasi-totality of Dakar households every lunch, and one dinner out of two (2). The national dish of Senegal, the "Tiebou-Dienne", has rice as its main ingredient. Because it is hard to see how food preferences would turn rapidly against rice by the year 2000, there appears to be little hope for a significant reduction of demand for rice.

D) Fourth key concept: the budget implications

The budget implications of a self sufficiency strategy are hard to estimate in detail. However, we can estimate at least the cost of developing the irrigated zone in order to meet the self-sufficiency objective.

The 1985 FAO study estimates that 38000 hectares must be irrigated by 1995 in order to meet the 75 % cereals self-sufficiency objective. If we accept a cost of 1.5 million CFAF per new irrigated hectare, we obtain a required investment cost of 57 billion CFA Francs.

This amount can be compared to the overall deficit in the national budget, estimated at -47.6 billion CFAF in 1983/84. It is clear that the development of the irrigated zone required to meet the self-sufficiency objective will impose a major burden on the state budget, unless donors take over part of the investment costs.

E) Fifth key concept: the foreign exchange constraint

The strategy followed until recently, which was based on specializing in the production and exportation of groundnut products and the importation of broken rice, has counted on exports to generate enough foreign exchange to pay for imports. Unfortunately, the latest forecast of the world market prospects for groundnut products is not encouraging. Projections indicate that the size of the world market, the world price, the market share of Senegal and thus exports of groundnut exports will stagnate (see TAB VII-A and -B).

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(1) See projections in tables TAB V-B and V-C.

(2) Ross, 1980.

The two major purchasers of Senegalese groundnut products are the European livestock breeders who feed their animals with groundnut meal and European consumers who use groundnut oil for cooking. The livestock breeders are tending to substitute soya meal for groundnut meal because the former gives leaner and thus higher value carcasses than the latter. Consumers are tending to substitute lighter oils such as sunflower or corn oils for groundnut oil.

Projections for cotton exports do not indicate any significant growth either. The world market for cotton is expected to remain stable during the foreseeable future. Moreover a rapid increase in cotton areage seems unlikely; because cotton exhausts soils quickly, new crop rotations (cotton, cereals and legumes) would have to be introduced, the adoption of which would probably take time. Therefore cotton exports are likely to remain around their present level (see TAB VII-A and -B).

The balance of trade in agricultural products is projected to deteriorate (see TAB VII-A and -B and graph 12). Traditional exports will be less and less able to generate the foreign exchange required to buy the quantity of cereals necessary to meet food needs. However, the growth of fish exports and of tourism should help alleviate the foreign exchange constraint.

The effect of a self-sufficiency strategy on net foreign exchange earnings is difficult to estimate. The ISRA/BAME study cited earlier should provide some useful information on this question. A self-sufficiency strategy would certainly involve higher imports of agricultural inputs. This is particularly the case for irrigated cultivation: heavy machinery to set up irrigated perimeters, water pumps, gas, oil, etc., must all be imported.

F) Sixth key concept: rapid evolution of the food situation

The optimal level of food self-sufficiency is a function of the structure of food supply and demand, which is evolving rapidly. Let us mention a few examples:

- The extension of double cropping planned after the completion of the Manatali dam could reduce considerably the costs of production for irrigated cultivation.

- The decrease in the oil price in 1985/86 led to a decrease in the cost of imported fertilizers. For example, SAED (1) sold urea at CFAF 118 per kilo in 1985 and at CFAF 80.5 per kilo in 1986 (2). Such changes in fertilizer prices modify significantly the

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(1) The "Société d'Aménagement et d'Exploitation des Terres du Delta du Fleuve Sénégal et des Vallées du Fleuve Sénégal et de la Falémé" (SAED) is a parastatal responsible for the development of irrigated cultivation in the Senegal River Basin.

(2) The 1985 price excludes the CFAF 20 subsidy from USAID. The 1986 price is for purchase on credit, which is the most common mode of payment. The cash price was CFAF 74.5 in 1986.

- costs of production in Senegal. However, they affect costs in other countries as well, hence the net impact on comparative advantage is not clear.

- The institutional context is changing rapidly with the withdrawal of the state and the progressive transfer to the private sector of agricultural input and output marketing. These reforms will, among other things, modify the availability and the cost of inputs, and hence the costs of production in Senegal.

It is hard to evaluate the impact of these reforms ex ante. This topic would require a separate study. The hope is that economic costs will decrease as a result of greater efficiency in the private sector. This assumes real competition among traders, rather than a situation of oligopoly or monopoly.

To conclude this third part, although food self-sufficiency is clearly a valid objective, it is not clear whether 80 % cereals self-sufficiency is a desirable level given the likely economic costs of achieving it.

On the one hand, Senegal's lack of comparative advantage in food crop production (especially rice), its rice-oriented food habits, and the high cost of irrigation development relative to government budgetary resources, all suggest that a high level of food self-sufficiency can be achieved only at a high economic cost.

On the other hand, political considerations and the desirability of improving the stability and the level of net foreign exchange earnings argue in favor of a relatively high level of cereals self-sufficiency. In any case, the optimal cereals self-sufficiency level will vary depending on how the food situation evolves. It is one of the objectives of the BAME research program to examine this question.

4 - Implications for research to improve the analysis of the food situation in Senegal

Agroeconomic research should be able to provide more insights to the government about the realism and desirability of different levels of food self-sufficiency. Two research topics have priority: the analysis of the costs of production in Senegal, and a better understanding of the decision process of the different micro-economic agents: the farmer, the trader and the consumer.

On the production side, the BAME is currently finalizing the preparation of a set of crop budgets for Senegal (1). These budgets sum up, using a consistent methodology, the revenues, costs and margins for the major crops in Senegal, disaggregated into eleven production zones. On the marketing side, several producer and trader

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(1) Martin, 1987.

surveys are being conducted by the BAME in the Peanut Basin and in the Middle and Upper Casamance, which are key regions for future agricultural development (1).

As far as methodology is concerned, research must incorporate uncertainty and the dynamic nature of the food situation. It must also consider the food situation both at the microeconomic and at the macroeconomic levels, recognizing the link between these two levels of analysis.

The BAME has also initiated a modelling exercise which attempts to incorporate these different elements (2). This exercise involves the construction of a model for a representative farming system in each of eleven production zones in Senegal. The models include explicit farm-level food security considerations. These regional models are then integrated in a national model that includes the major food security objectives of the government.

This exercise should enable us to evaluate alternative food strategies according to several criteria such as the economic costs of meeting the population's food needs, the level of food self-sufficiency, the agricultural balance of trade, etc. The analysis is being conducted for 1986, and for a point 15 years into the future, based on projections of technological change, the production environment, population growth, and world prices.

CONCLUSION

This paper has examined the food situation in Senegal from a food policy perspective. The evolution of food supply and demand from 1974 to 1985 was analyzed. Two major policy issues were identified regarding the feasibility and the desirability of the new goal of the Senegalese government to reach 80 % food self-sufficiency by the year 2000. While improving the level of food self-sufficiency is a valid objective, the analysis suggests that a level of 80 % selfsufficiency will be difficult to achieve technically, and quite costly in economic terms. Whether these costs are likely to be offset by other benefits associated with higher food self-sufficiency is a question which lies outside the scope of this paper.

The nature of research needed to improve our analysis of the food situation in Senegal is outlined. Relevant research programs underway in the Bureau of Macroeconomic Analysis of ISRA are briefly reviewed.

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(1) Gaye, 1987; Ouedraogo and Ndoye, 1986; Goetz and Diagana, 1987.

(2) Martin, 1986.

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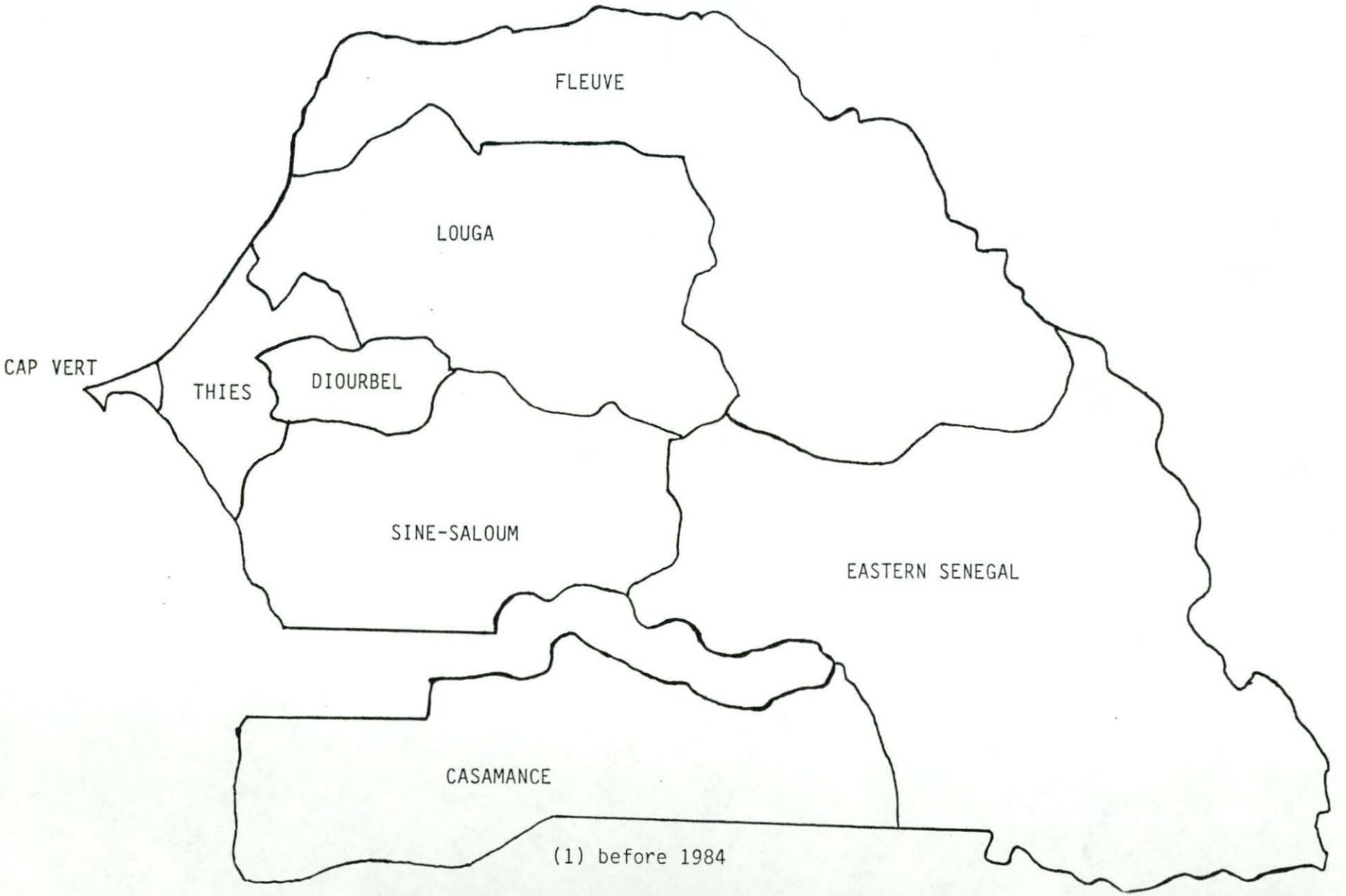
MAP 1

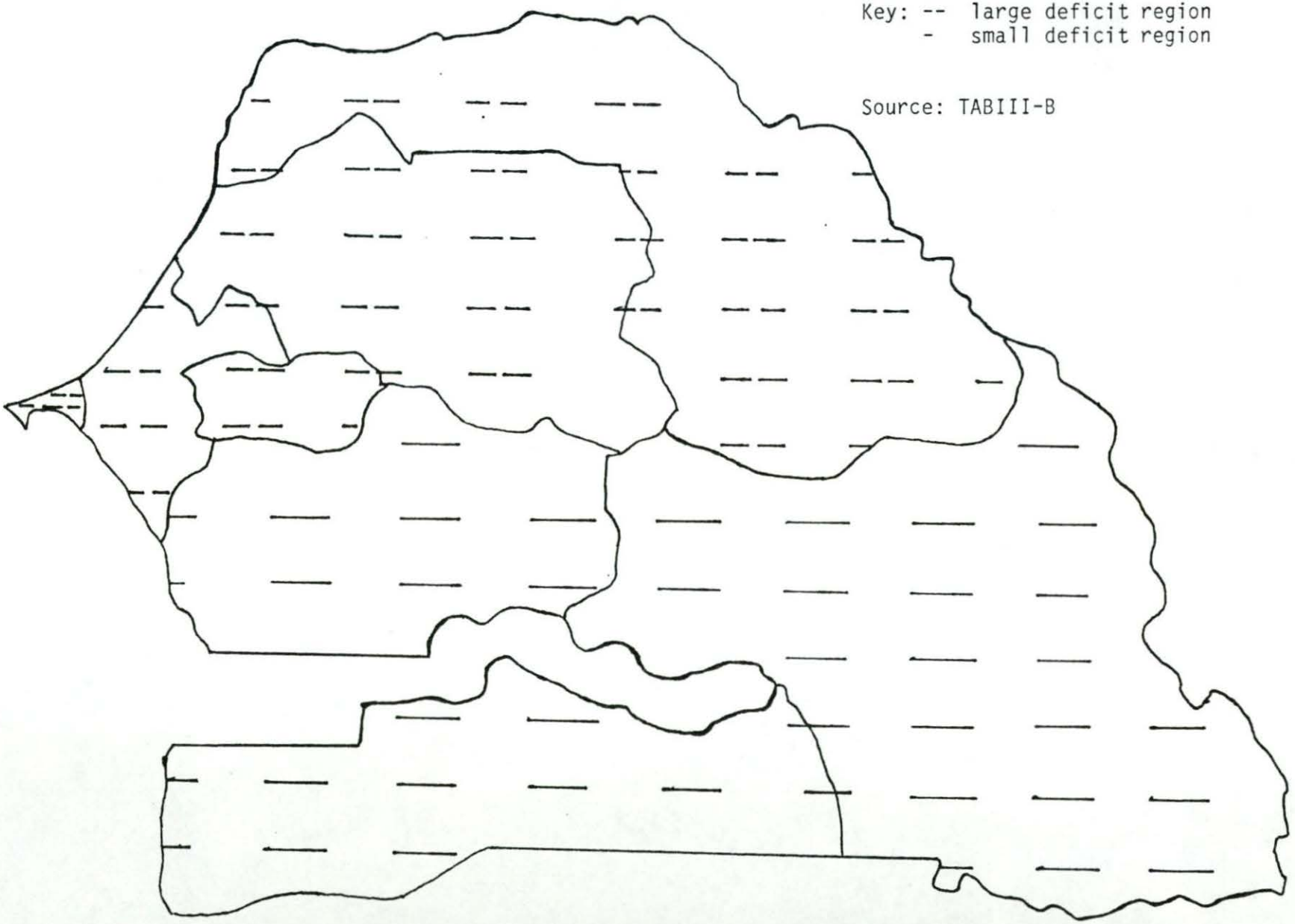
MAP OF ADMINISTRATIVE REGIONS IN SENEGAL (1)



(1) before 1984

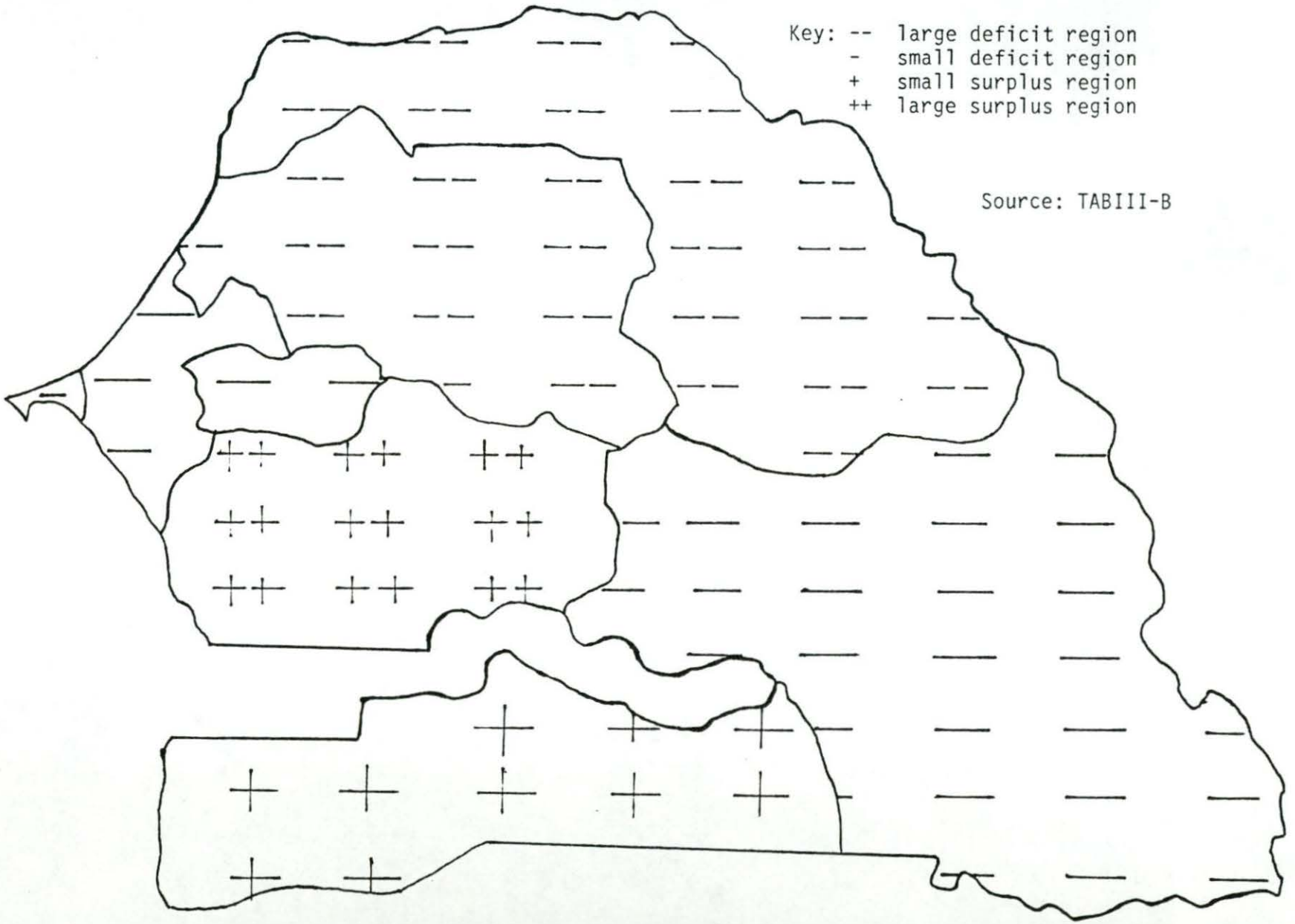
MAP 2

MAP OF SURPLUS AND DEFICIT REGIONS IN CEREALS IN 1983/85



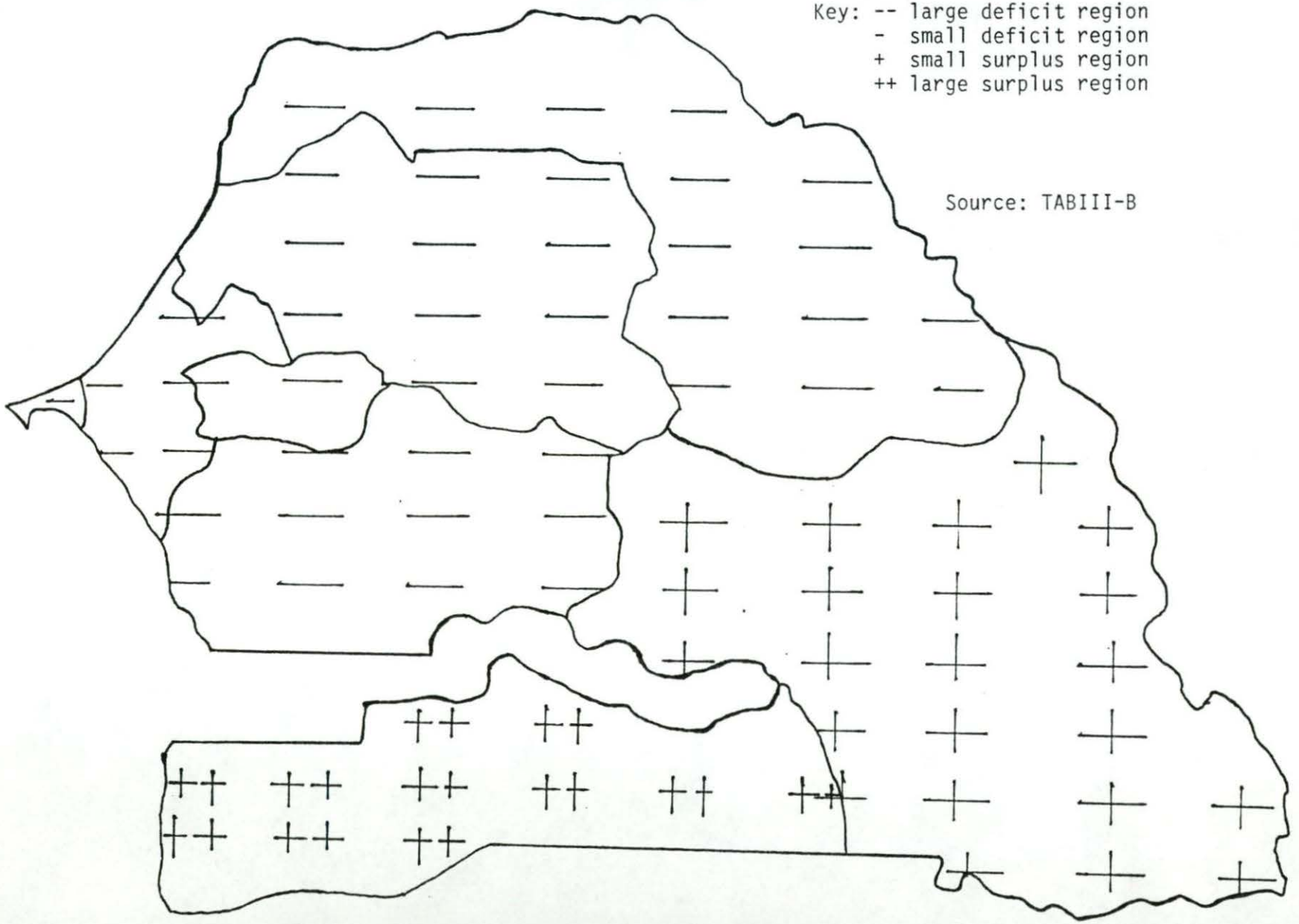
MAP 3

MAP OF SURPLUS AND DEFICIT REGIONS IN MILLET/SORGHUM IN 1983/85



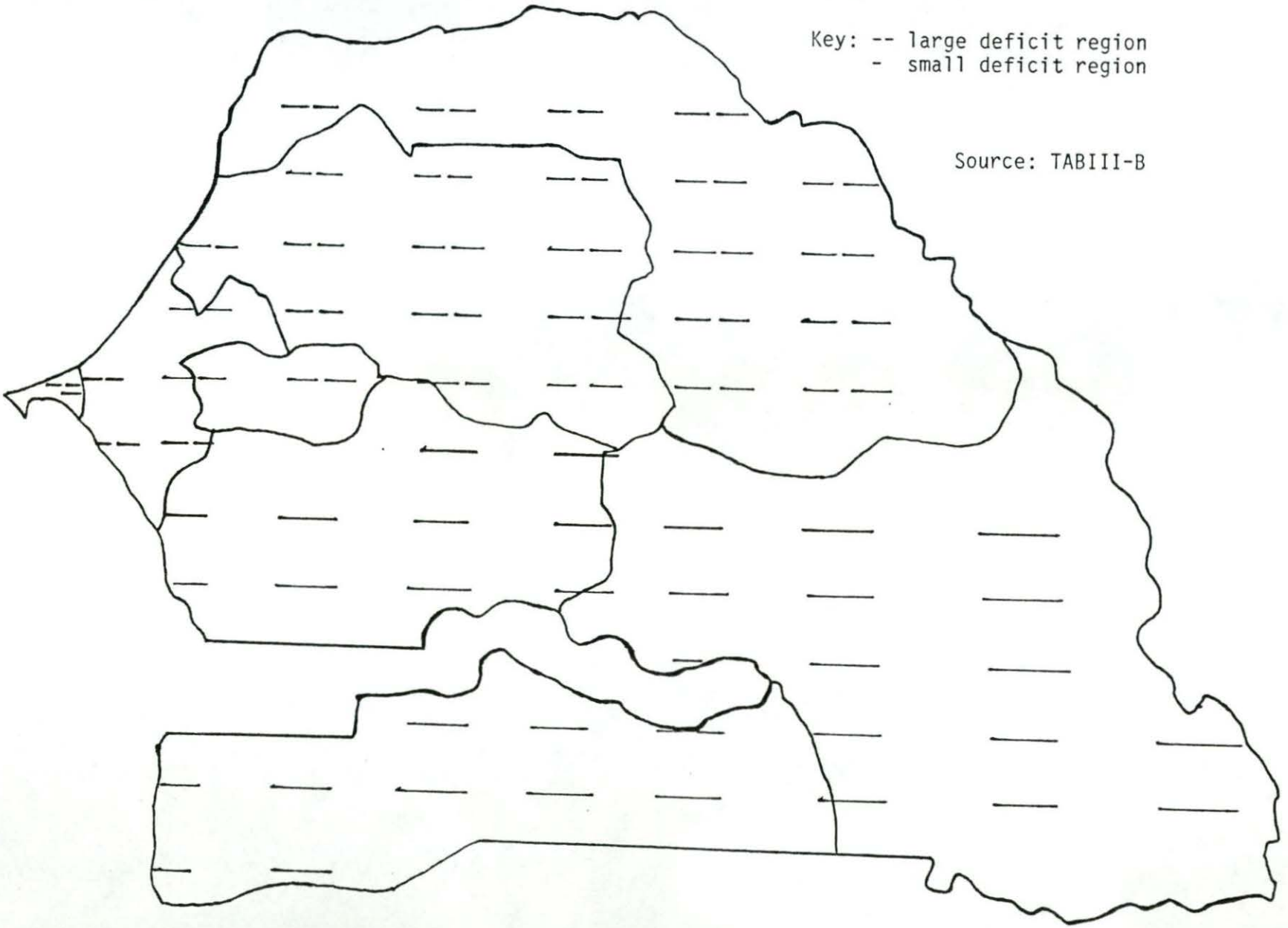
MAP 4

MAP OF SURPLUS AND DEFICIT REGIONS IN MAIZE IN 1983/85



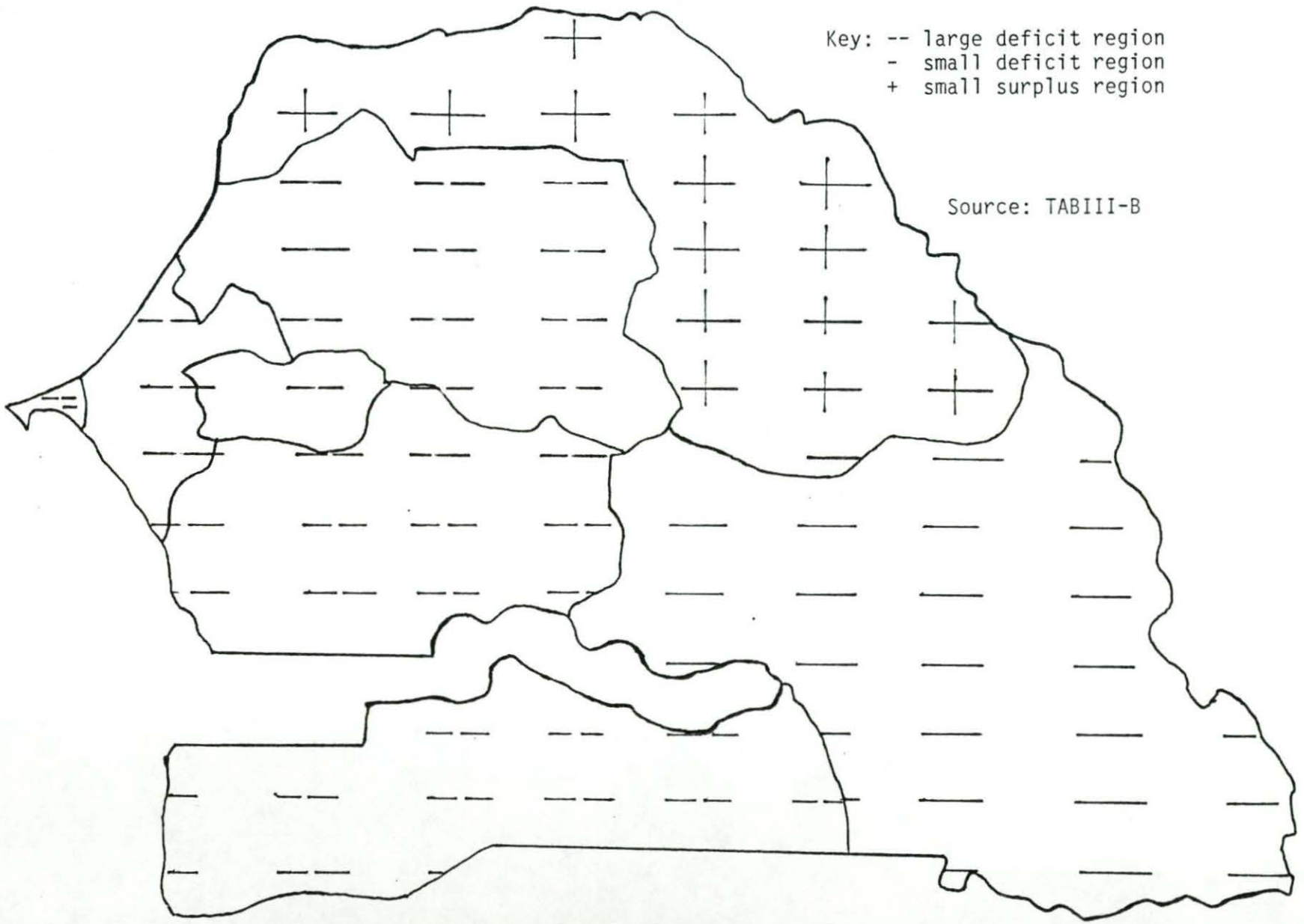
MAP 5

MAP OF SURPLUS AND DEFICIT REGIONS IN WHEAT IN 1983/85

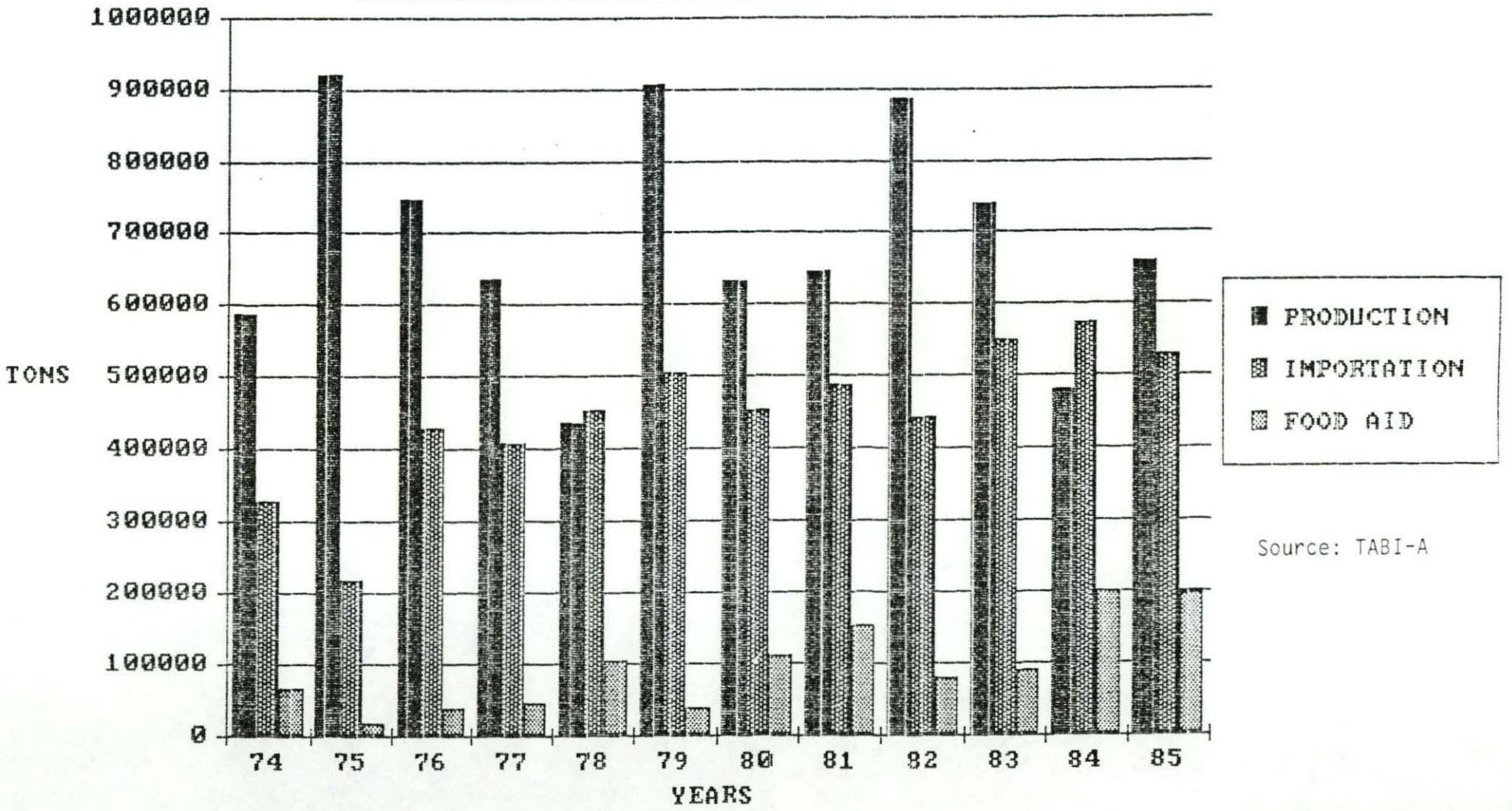


MAP 6

MAP OF SURPLUS AND DEFICIT REGIONS IN RICE IN 1983/85

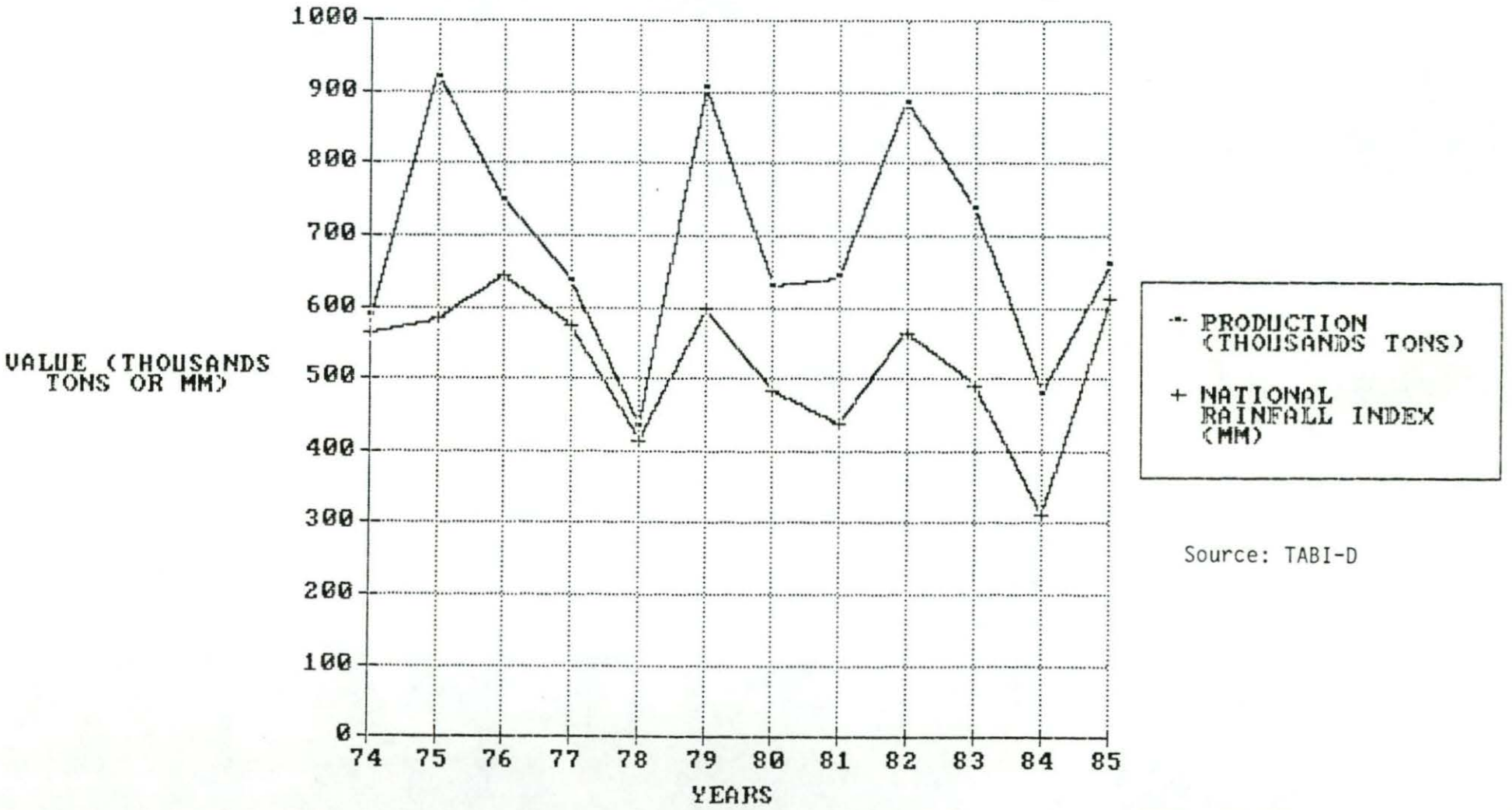


GRAPH 1: EVOLUTION OF THE NATIONAL SUPPLY OF CEREALS



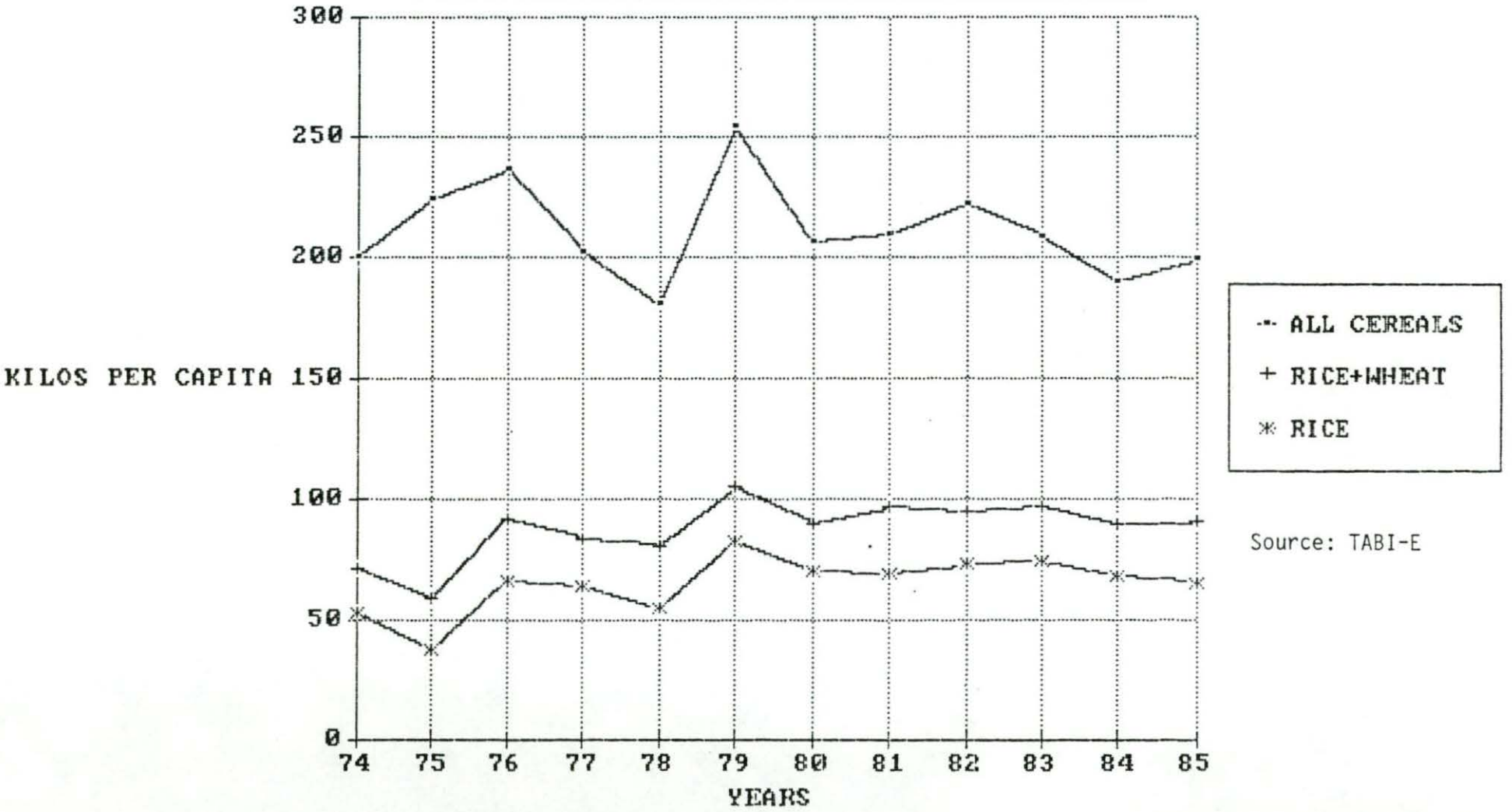
Source: TABI-A

GRAPH 2: EVOLUTION OF CEREALS NATIONAL PRODUCTION AND RAINFALL (1974-1985)



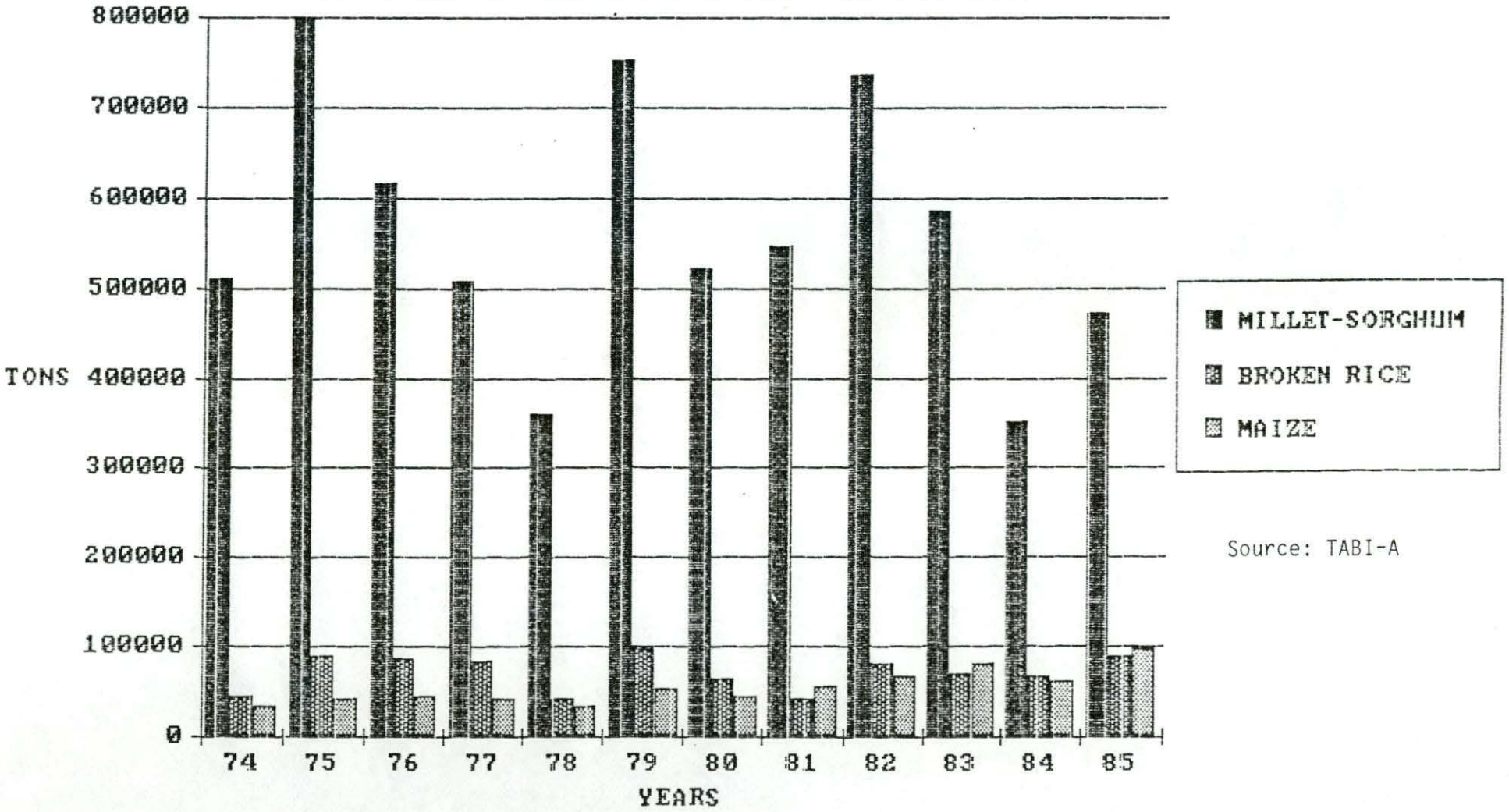
Source: TABI-D

GRAPH 3: EVOLUTION OF THE SUPPLY OF CEREALS PER CAPITA



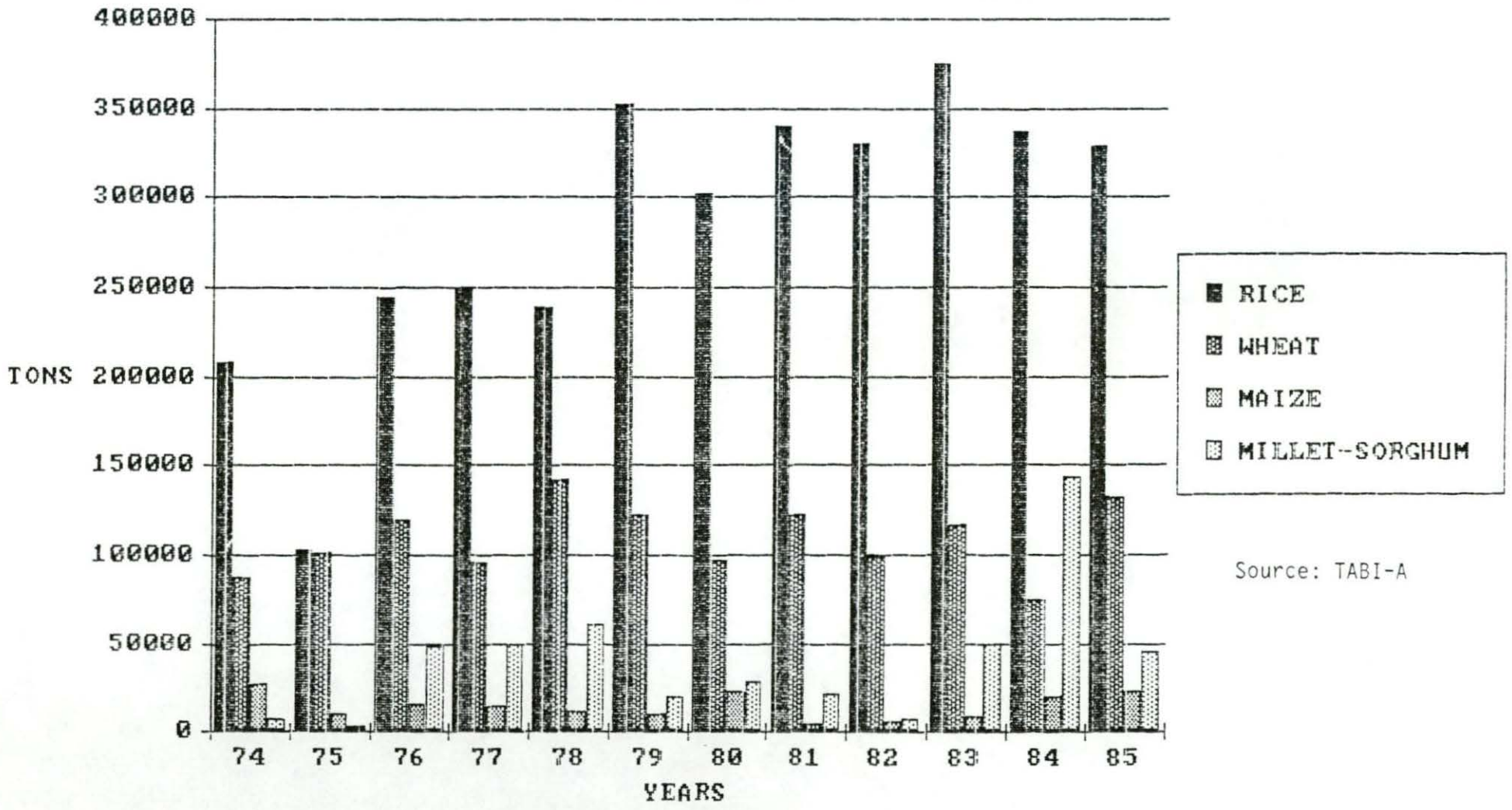
Source: TABI-E

GRAPH 4: EVOLUTION OF THE NATIONAL PRODUCTION OF CEREALS BY PRODUCT



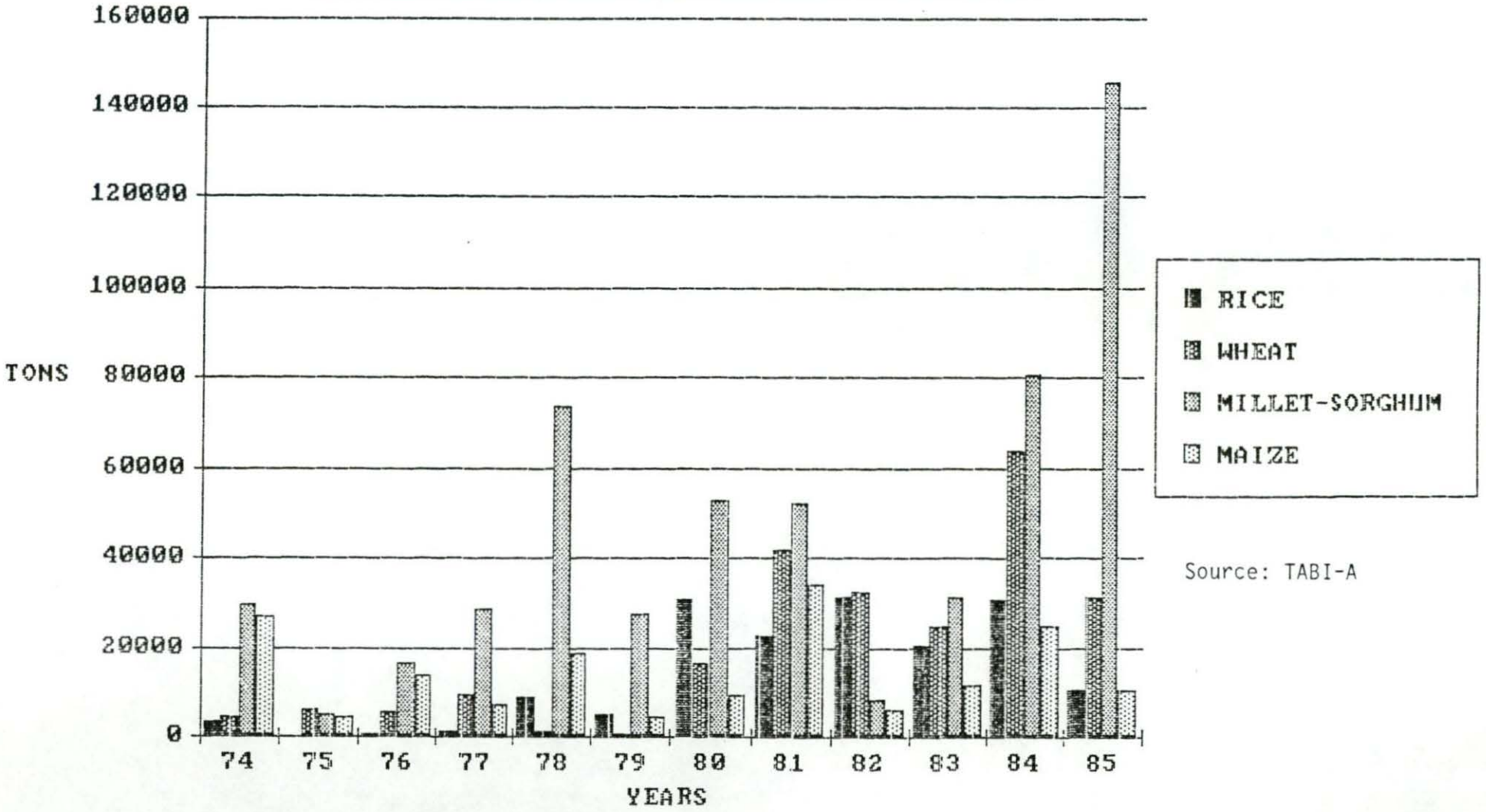
Source: TABI-A

GRAPH 5: EVOLUTION OF COMMERCIAL IMPORTS OF CEREALS BY PRODUCT



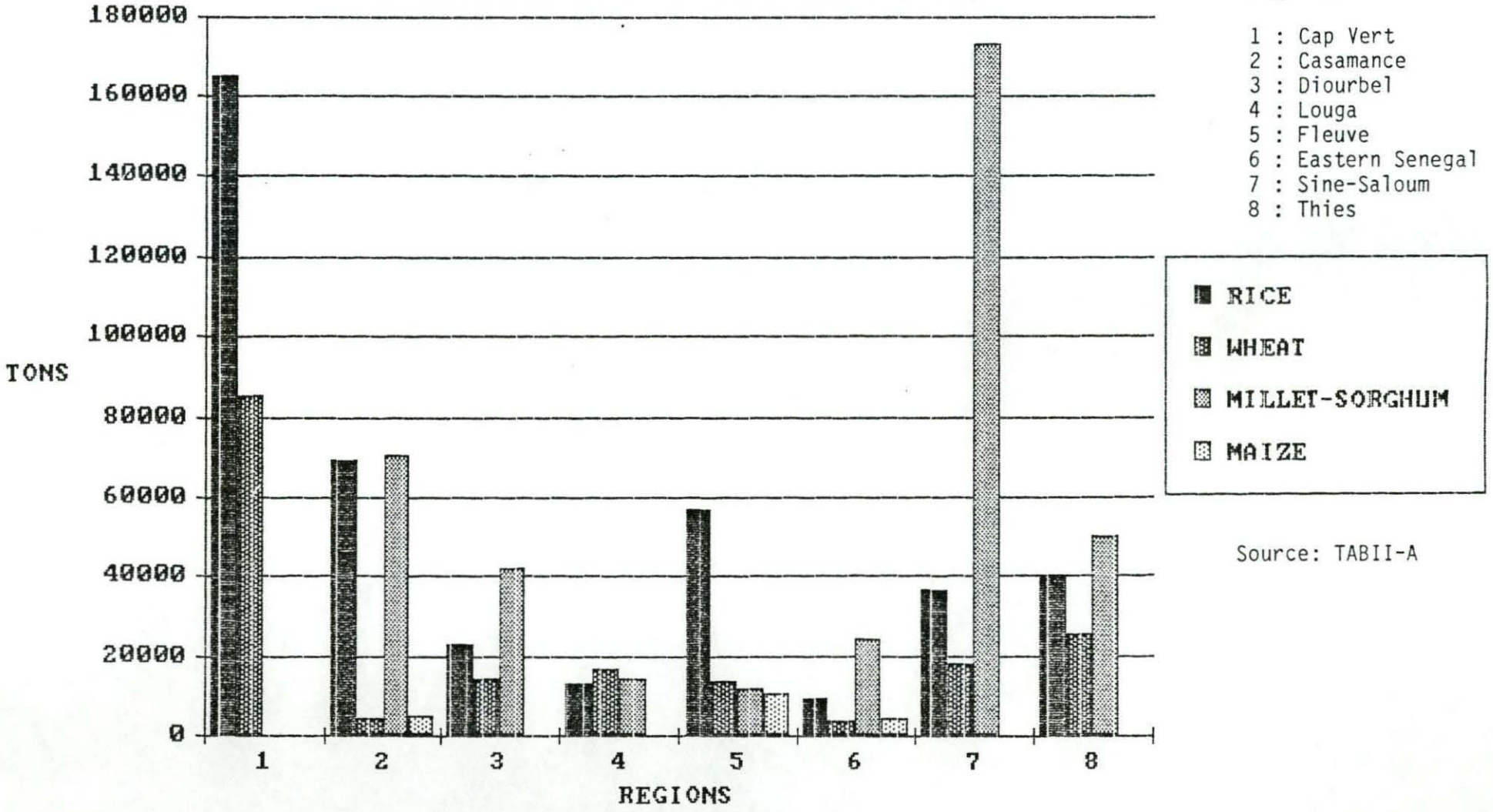
Source: TABI-A

GRAPH 6: EVOLUTION OF FOOD AID IN CEREALS BY PRODUCT



Source: TABI-A

GRAPH 7: DISAGGREGATION OF THE REGIONAL SUPPLY OF CEREALS BY PRODUCT IN 1983-85

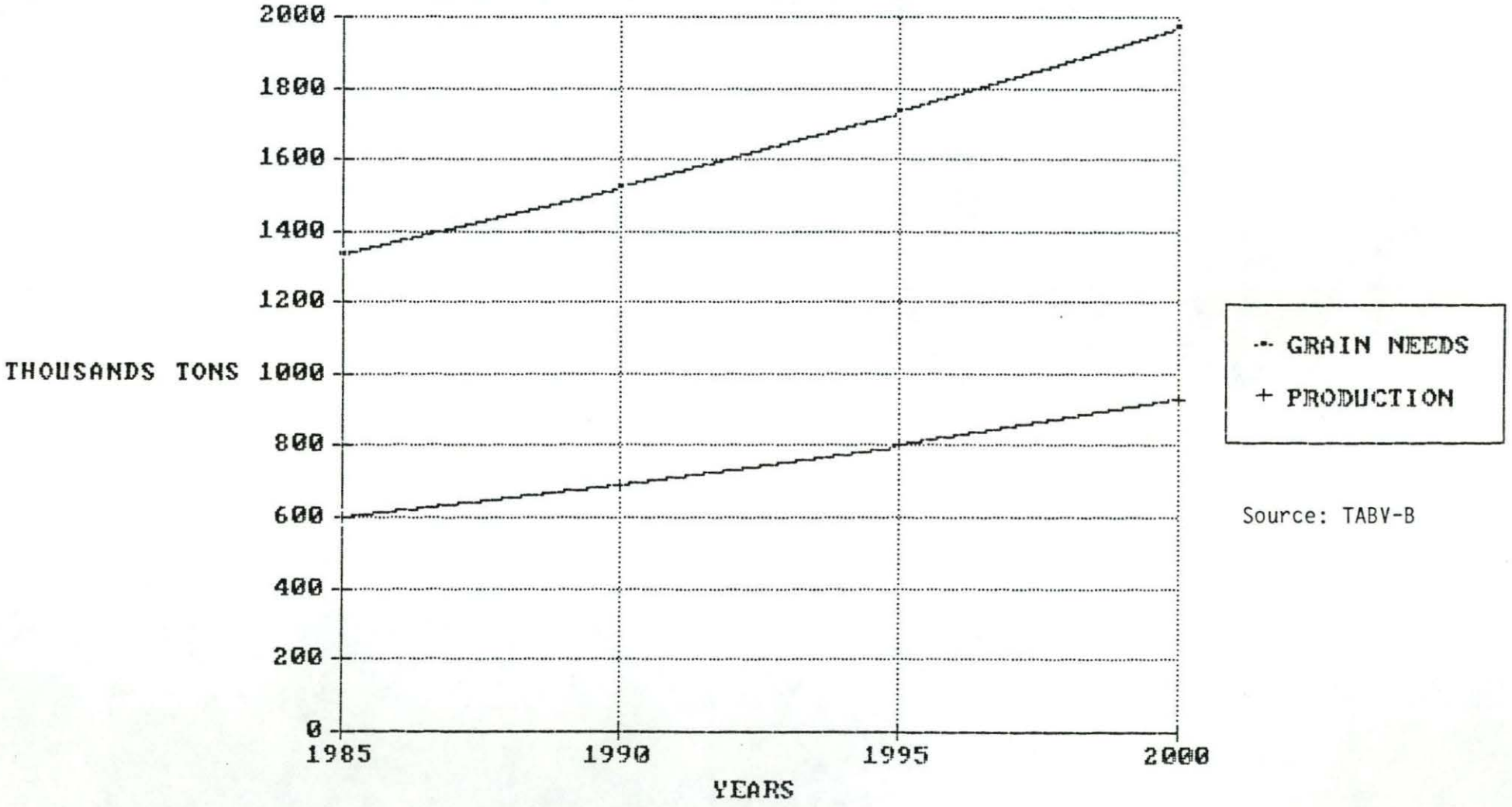


Regions:

1 : Cap Vert
2 : Casamance
3 : Diourbel
4 : Louga
5 : Fleuve
6 : Eastern Senegal
7 : Sine-Saloum
8 : Thies

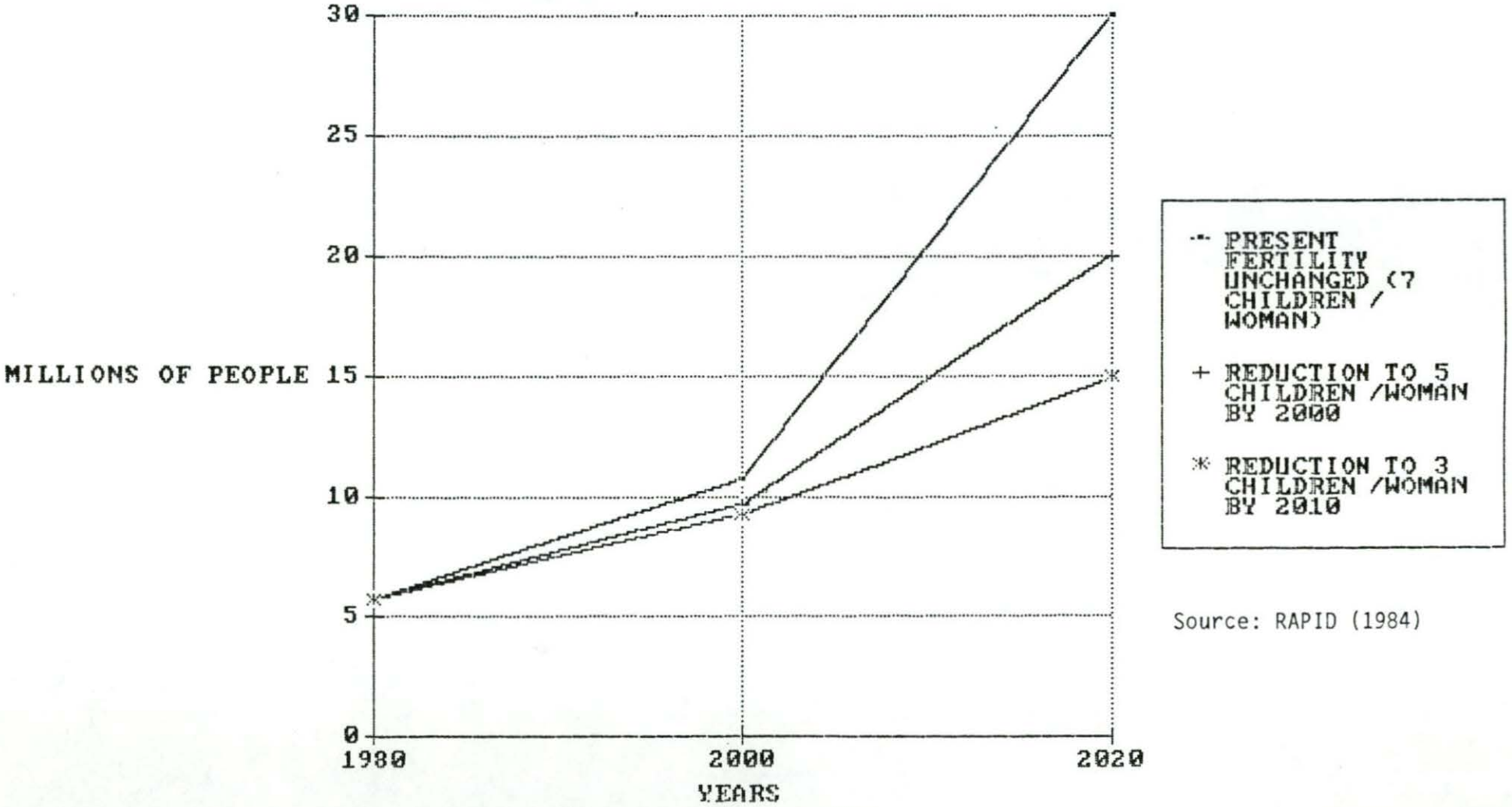
Source: TABII-A

GRAPH 8: PROJECTIONS OF GRAIN NEEDS AND DOMESTIC PRODUCTION FROM 1985 TO 2000



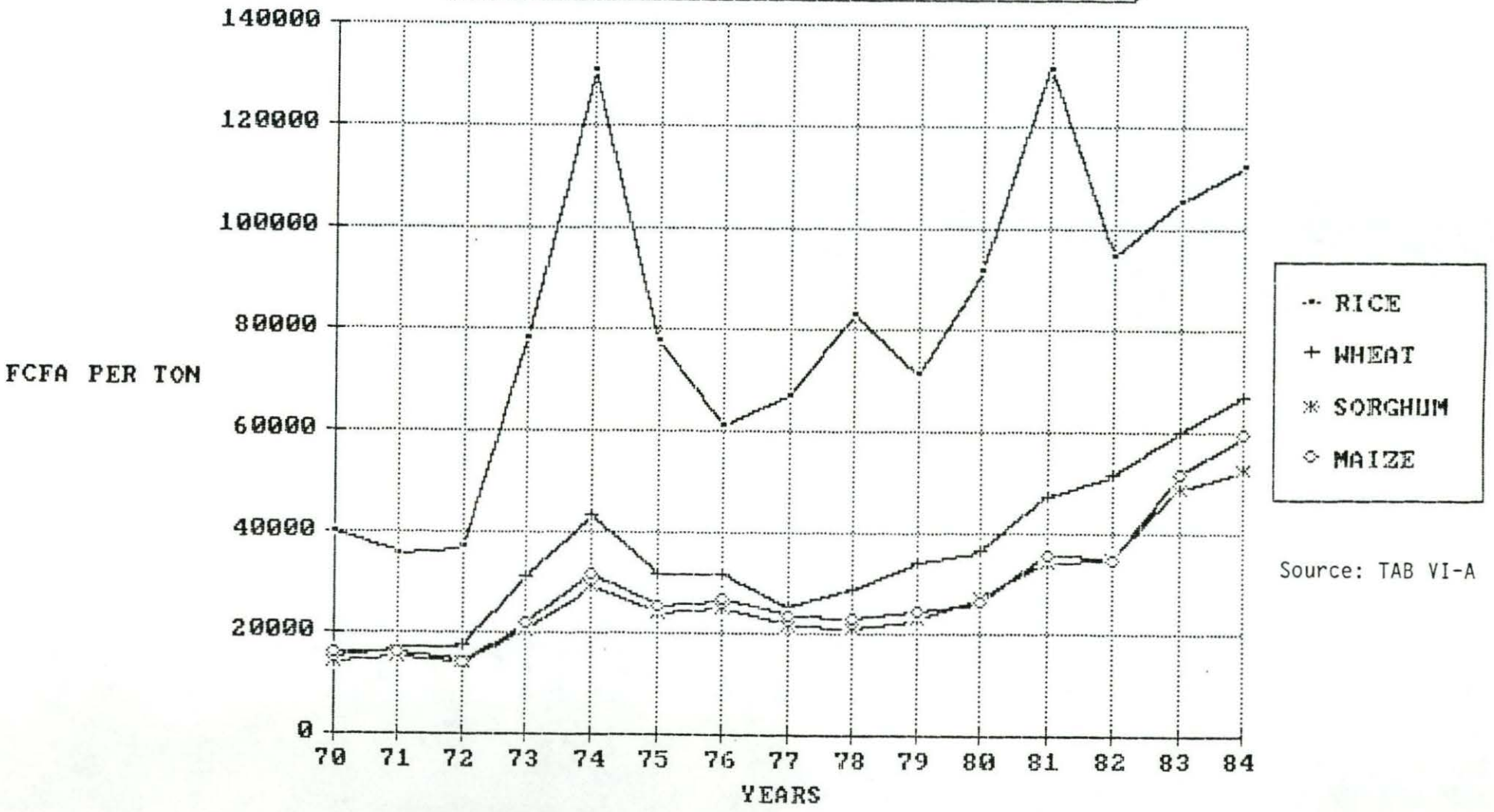
Source: TABV-B

GRAPH 9: POPULATION GROWTH UNDER ALTERNATIVE FERTILITY HYPOTHESES (1980-2030)



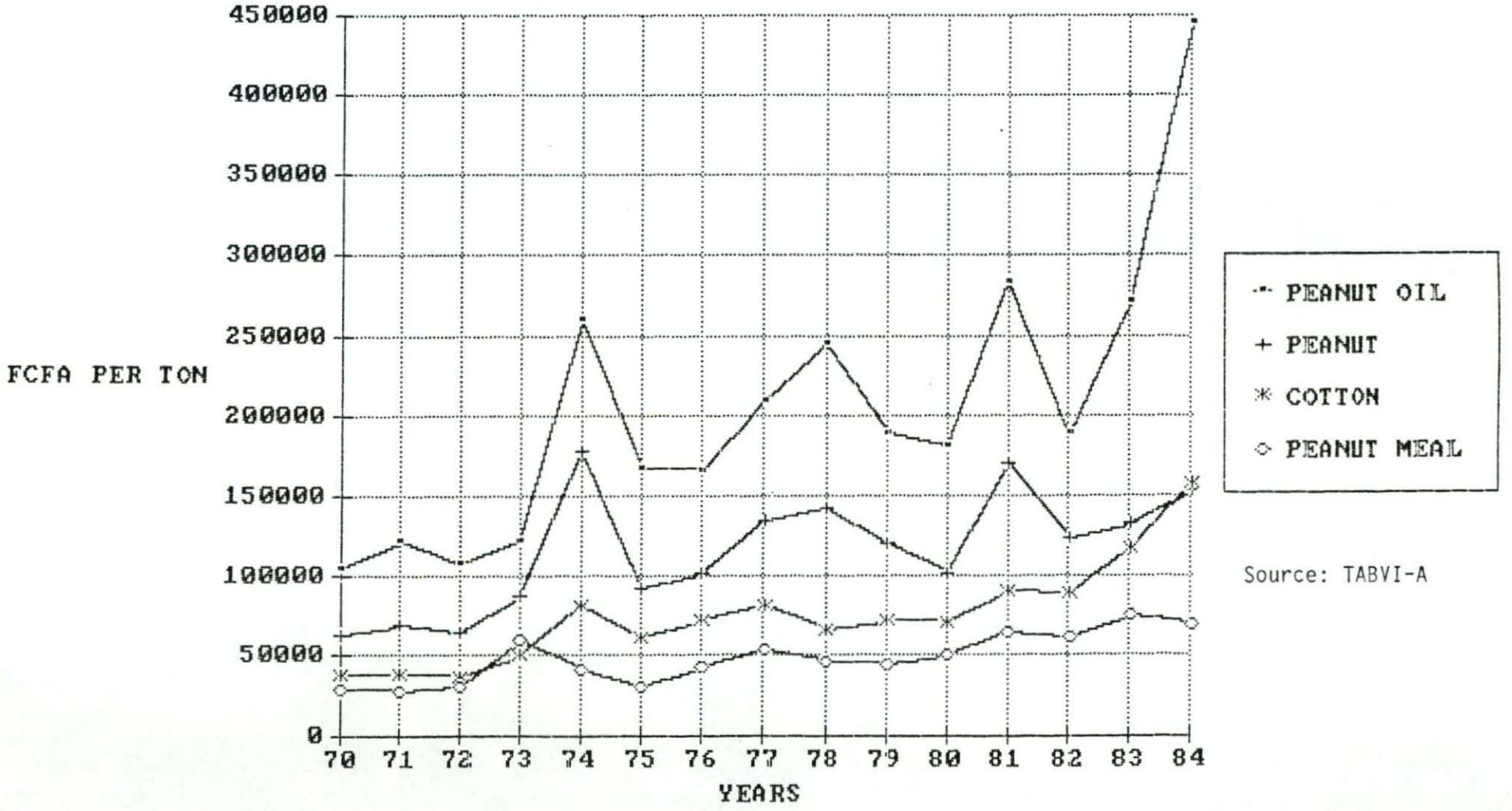
Source: RAPID (1984)

GRAPH 10-1: EVOLUTION OF WORLD PRICES FOR CEREALS



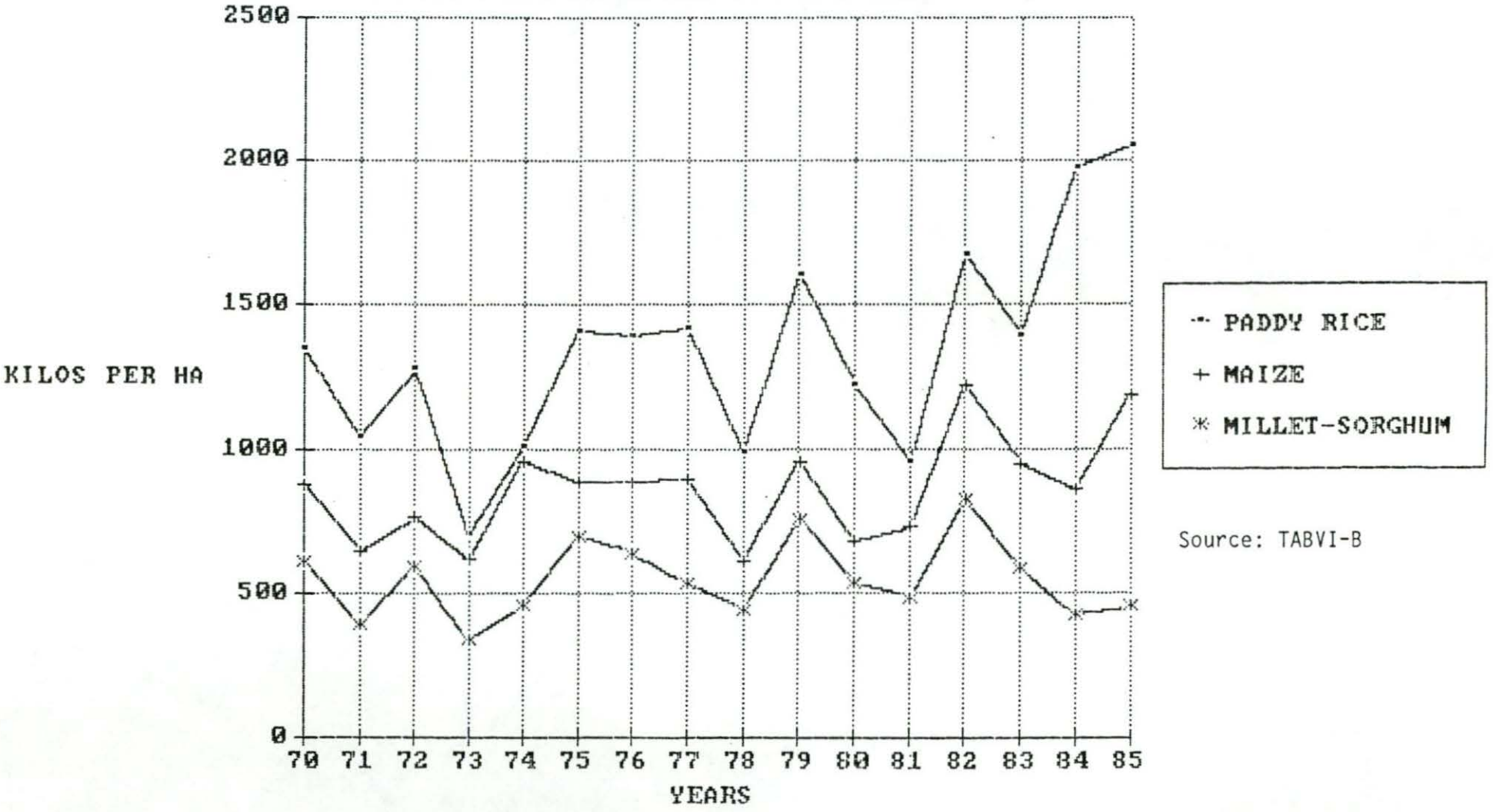
Source: TAB VI-A

GRAPH 10-2: EVOLUTION OF WORLD PRICES FOR EXPORT CROPS



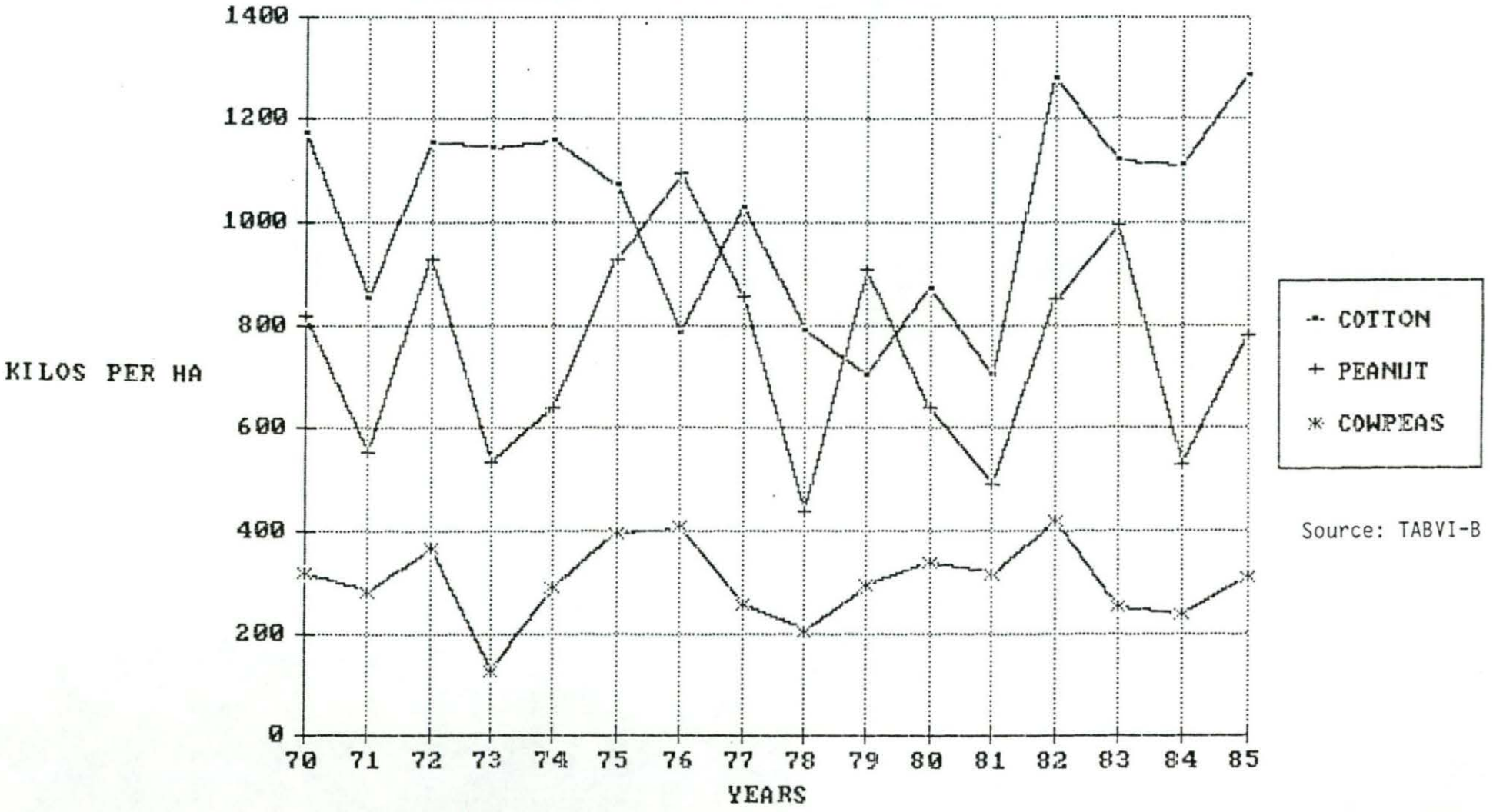
Source: TABVI-A

GRAPH 11-1: EVOLUTION OF YIELDS FOR SELECTED AGRICULTURAL PRODUCTS IN SENEGAL



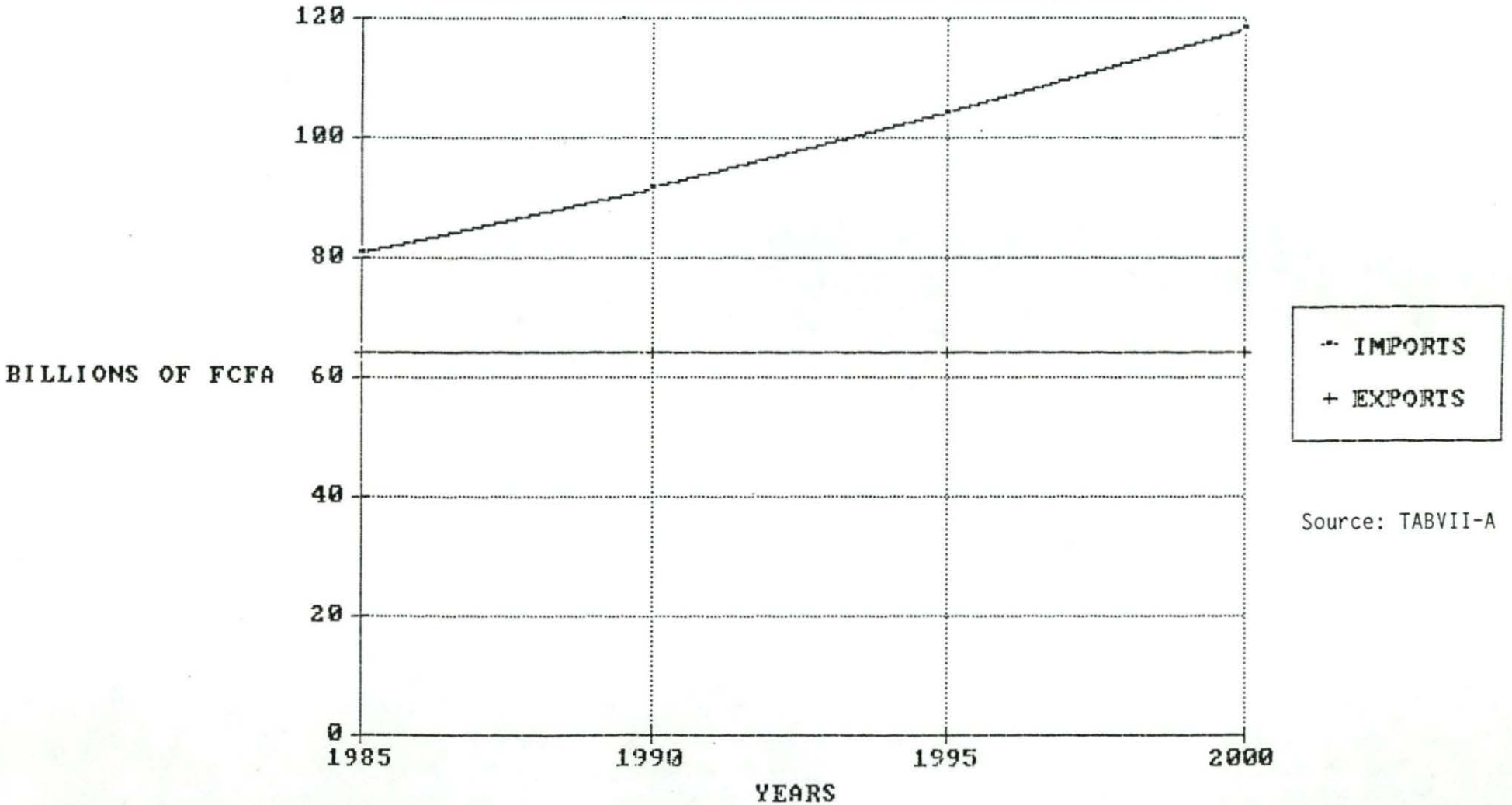
Source: TABVI-B

GRAPH 11-2: EVOLUTION OF YIELDS FOR SELECTED AGRICULTURAL PRODUCTS IN SENEGAL (CONTINUED)



Source: TABVI-B

GRAPH 12: PROJECTIONS OF THE BALANCE OF TRADE FOR AGRICULTURAL PRODUCTS FROM 1985 TO 2000



Source: TABVII-A

TABI-A: EVOLUTION OF THE NATIONAL SUPPLY OF CEREALS (1974-1985)

UNITS:TONS

YEARS	NATIONAL PRODUCTION				COMMERCIAL IMPORTS					FOOD AID					TOTAL				
	MILLET SORGHUM	MAIZE	PROCESSED RICE	TOTAL CEREALS	MILLET SORGHUM	MAIZE	PROCESSED RICE	WHEAT	TOTAL CEREALS	MILLET SORGHUM	MAIZE	PROCESSED RICE	WHEAT	TOTAL CEREALS	MILLET SORGHUM	MAIZE	PROCESSED RICE	WHEAT	TOTAL CEREALS
1974	510200	33800	43684	587684	7200	26900	207200	86700	328000	29756	27131	3218	4425	64530	547156	87831	254102	91125	980214
1975	796200	43200	80668	920068	2500	9600	102100	101900	216100	5052	4387	0	6277	15716	803752	57187	182768	108177	1151884
1976	616400	44400	87234	748034	48200	15100	244500	119900	427700	16574	13760	775	5629	36738	681174	73260	332509	125529	1212472
1977	507600	43500	84420	635520	49300	13800	248000	96000	407100	28587	7195	969	9477	46228	585487	64495	333389	105477	1088848
1978	360200	33200	42210	435610	60300	12000	239000	142400	453700	73796	18461	8790	1145	102192	494296	63661	290000	143545	991502
1979	752000	54100	98088	904188	19900	9400	351900	122900	504100	27735	4422	5009	872	38038	799635	67922	454997	123772	1446326
1980	520600	46200	64722	631522	28900	23200	302500	97200	451600	52801	9664	30539	16782	109786	602301	79064	397761	113982	1193108
1981	545000	57000	43349	645349	21700	4500	339800	121800	487800	52427	33935	22319	41741	150422	619127	95435	405468	163541	1283571
1982	736400	68000	80400	884800	7785	5755	329380	99166	442086	8281	6246	31161	32596	78284	752466	80001	440941	131762	1405170
1983	585200	82200	70484	737884	48777	8428	374329	116513	548047	31357	11728	20308	24500	87893	665334	102356	465121	141013	1373824
1984	352000	60558	68005	480563	143536	19970	336600	74142	574248	80853	24547	30570	64000	199970	576389	105075	435175	138142	1254781
1985	471456	98450	91005	660911	44593	22031	328772	132362	527758	145470	10592	10526	31500	198090	661519	131073	430305	163862	1386759
AVERAGE	562771	55384	71189	689344	40224	14224	283673	109243	447370	46057	14339	13682	19912	93991	649053	83947	368545	129161	1230705

SOURCES:

DIRECTION DE L'AGRICULTURE FOR NATIONAL PRODUCTION
DIRECTION DE LA STATISTIQUE FOR COMMERCIAL IMPORTS
CSA FOR FOOD AID

TABI-B: EVOLUTION OF THE NATIONAL SUPPLY OF CEREALS IN PERCENTAGE BY ORIGIN (1974-85)

YEARS	NATIONAL PRODUCTION	COMMERCIAL IMPORTS	FOOD AID	TOTAL SUPPLY
1974	60.0%	33.5%	6.6%	100.0%
1975	79.9%	18.8%	1.4%	100.0%
1976	61.7%	35.3%	3.0%	100.0%
1977	58.4%	37.4%	4.2%	100.0%
1978	43.9%	45.8%	10.3%	100.0%
1979	62.5%	34.9%	2.6%	100.0%
1980	52.9%	37.9%	9.2%	100.0%
1981	50.3%	38.0%	11.7%	100.0%
1982	63.0%	31.5%	5.6%	100.0%
1983	53.7%	39.9%	6.4%	100.0%
1984	38.3%	45.8%	15.9%	100.0%
1985	47.7%	38.1%	14.3%	100.0%
AVERAGE	56.0%	36.4%	7.6%	100.0%

SOURCES:

SEE TABI-A

TABI-C: EVOLUTION OF THE NATIONAL SUPPLY OF CEREALS IN PERCENTAGE BY PRODUCT (1974-1985)

YEARS	NATIONAL PRODUCTION				COMMERCIAL IMPORTS					FOOD AID					TOTAL				
	MILLET SORGHUM	MAIZE	PROCESSED RICE	TOTAL CEREALS	MILLET SORGHUM	MAIZE	PROCESSED RICE	WHEAT	TOTAL CEREALS	MILLET SORGHUM	MAIZE	PROCESSED RICE	WHEAT	TOTAL CEREALS	MILLET SORGHUM	MAIZE	PROCESSED RICE	WHEAT	TOTAL CEREALS
1974	86.8%	5.8%	7.4%	100.0%	2.2%	8.2%	63.2%	26.4%	100.0%	46.1%	42.0%	5.0%	6.9%	100.0%	55.8%	9.0%	25.9%	9.3%	100.0%
1975	86.5%	4.7%	8.8%	100.0%	1.2%	4.4%	47.2%	47.2%	100.0%	32.1%	27.9%	0.0%	39.9%	100.0%	69.8%	5.0%	15.9%	9.4%	100.0%
1976	82.4%	5.9%	11.7%	100.0%	11.3%	3.5%	57.2%	28.0%	100.0%	45.1%	37.5%	2.1%	15.3%	100.0%	56.2%	6.0%	27.4%	10.4%	100.0%
1977	79.9%	6.8%	13.3%	100.0%	12.1%	3.4%	60.9%	23.6%	100.0%	61.8%	15.6%	2.1%	20.5%	100.0%	53.8%	5.9%	30.6%	9.7%	100.0%
1978	82.7%	7.6%	9.7%	100.0%	13.3%	2.6%	52.7%	31.4%	100.0%	72.2%	18.1%	8.6%	1.1%	100.0%	49.9%	6.4%	29.2%	14.5%	100.0%
1979	83.2%	6.0%	10.8%	100.0%	3.9%	1.9%	69.8%	24.4%	100.0%	72.9%	11.6%	13.2%	2.3%	100.0%	55.3%	4.7%	31.5%	8.6%	100.0%
1980	82.4%	7.3%	10.2%	100.0%	6.4%	5.1%	67.0%	21.5%	100.0%	48.1%	8.8%	27.8%	15.3%	100.0%	50.5%	6.6%	33.3%	9.6%	100.0%
1981	84.5%	8.8%	6.7%	100.0%	4.4%	0.9%	69.7%	25.0%	100.0%	34.9%	22.6%	14.8%	27.7%	100.0%	48.2%	7.4%	31.6%	12.7%	100.0%
1982	83.2%	7.7%	9.1%	100.0%	1.8%	1.3%	74.5%	22.4%	100.0%	10.6%	8.0%	39.8%	41.6%	100.0%	53.5%	5.7%	31.4%	9.4%	100.0%
1983	79.3%	11.1%	9.6%	100.0%	8.9%	1.5%	68.3%	21.3%	100.0%	35.7%	13.3%	23.1%	27.9%	100.0%	48.4%	7.5%	33.9%	10.3%	100.0%
1984	73.2%	12.6%	14.2%	100.0%	25.0%	3.5%	58.6%	12.9%	100.0%	40.4%	12.3%	15.3%	32.0%	100.0%	45.9%	8.4%	34.7%	11.0%	100.0%
1985	71.3%	14.9%	13.8%	100.0%	8.4%	4.2%	62.3%	25.1%	100.0%	73.4%	5.3%	5.3%	15.9%	100.0%	47.7%	9.5%	31.0%	11.8%	100.0%
AVERAGE	81.3%	8.3%	10.4%	100.0%	8.2%	3.4%	62.6%	25.8%	100.0%	47.8%	18.6%	13.1%	20.5%	100.0%	52.9%	6.8%	29.7%	10.5%	100.0%

SOURCES:

SEE TABI-A

TABI-D: EVOLUTION OF RAINFALL AND CEREALS PRODUCTION
(1974-1985)

YEARS	CEREALS PRODUCTION (THOUSAND TONS)	RAINFALL INDEX (IN MM'S OF RAIN)
1974	588	565
1975	920	583
1976	748	645
1977	636	573
1978	436	415
1979	904	600
1980	632	482
1981	645	436
1982	885	563
1983	738	491
1984	481	313
1985	661	613

SOURCE: DIRECTION DE L'AGRICULTURE

TABI-E: EVOLUTION OF THE CEREALS SUPPLY PER CAPITA BY PRODUCT (1974-1985)

UNITS : KILOS PER CAPITA

YEARS	MILLET SORGHUM	MAIZE	RICE	WHEAT	TOTAL CEREALS
1974	112.8	18.1	52.4	18.8	202.1
1975	161.5	11.5	36.7	21.7	231.4
1976	136.3	14.7	66.5	25.1	242.6
1977	112.2	12.4	63.9	20.2	208.7
1978	92.3	11.9	54.2	26.8	185.2
1979	145.2	12.3	82.6	22.5	262.6
1980	106.3	13.9	70.2	20.1	210.5
1981	105.5	16.3	69.1	27.9	218.7
1982	124.6	13.2	73.0	21.8	232.7
1983	107.0	16.5	74.8	22.7	221.0
1984	90.3	16.5	68.2	21.6	196.6
1985	100.7	20.0	65.5	24.9	211.1
AVERAGE	116.2	14.8	64.8	22.8	218.6

SOURCES:

DIRECTION DE L'AGRICULTURE FOR NATIONAL PRODUCTION
DIRECTION DE LA STATISTIQUE FOR COMMERCIAL IMPORTS AND POPULATION
CSA FOR FOOD AID

TABII-A: REGIONAL DISTRIBUTION OF THE CEREALS SUPPLY IN 1983-1985

UNITS : TONS

REGIONS	REGIONAL PRODUCTION				COMMERCIAL IMPORTS					FOOD AID					TOTAL				
	MILLET SORGHUM	MAIZE	PROCESSED RICE	TOTAL CEREALS	MILLET SORGHUM	MAIZE	PROCESSED RICE	WHEAT	TOTAL CEREALS	MILLET SORGHUM	MAIZE	PROCESSED RICE	WHEAT	TOTAL CEREALS	MILLET SORGHUM	MAIZE	PROCESSED RICE	WHEAT	TOTAL CEREALS
CAP VERT	0	0	0	0	75	0	158733	69427	228235	490	0	4790	0	5279	564	0	163523	69427	233514
CASAMANCE	90154	46473	26774	163401	14250	8156	37699	3661	63766	3066	3999	15679	0	22745	107470	58629	80152	3661	249912
DIOURBEL	42541	0	0	42541	7396	0	22487	7408	37291	5841	0	0	4480	10321	55778	0	22487	11888	90153
LOUGA	1066	0	0	1066	2447	0	12566	3079	18093	14945	0	0	10680	25625	18459	0	12566	13759	44785
FLEUVE	9391	2090	46358	57839	3182	1686	15212	8474	28554	11424	8342	0	2680	22446	23997	12119	61570	11154	108839
EASTERN SENEGAL	31460	21548	3060	56068	4978	4005	6581	1540	17104	1108	3234	0	1736	6078	37546	28787	9641	3276	79249
SINE SALOUM	225385	18332	0	243717	36055	2963	36046	3941	79004	10479	0	0	10756	21235	271918	21294	36046	14697	343955
THIES	59633	0	0	59633	10593	0	37038	10143	57773	9620	0	0	10440	20060	79846	0	37038	20583	137466

SOURCES:

- DIRECTION DE L'AGRICULTURE FOR NATIONAL PRODUCTION
- CPSP FOR THE REGIONAL DISTRIBUTION OF RICE COMMERCIAL IMPORTS
- CSA FOR THE REGIONAL DISTRIBUTION OF FOOD AID
- CONTROLE ECONOMIQUE AND SURVEY OF THE 10 MOST IMPORTANT WHEAT FLOUR WHOLESALERS IN DAKAR FOR THE REGIONAL DISTRIBUTION OF WHEAT COMMERCIAL IMPORTS
- HYPOTHESIS MADE FOR THE REGIONAL DISTRIBUTION OF MAIZE AND MILLET/SORGHUM COMMERCIAL IMPORTS: REGIONAL DISTRIBUTION IDENTICAL TO THE SUM OF THE REGIONAL PRODUCTION AND FOOD AID OF THOSE PRODUCTS

TABII-B: REGIONAL DISTRIBUTION OF THE CEREALS SUPPLY BY ORIGIN IN 1983-1985

REGIONS	REGIONAL PRODUCTION	COMMERCIAL IMPORTS	FOOD AID	TOTAL
CAP VERT	0.0%	97.7%	2.3%	100.0%
CASAMANCE	65.4%	25.5%	9.1%	100.0%
DIOURBEL	47.2%	41.4%	11.4%	100.0%
LOUGA	2.4%	40.4%	57.2%	100.0%
FLEUVE	53.1%	26.2%	20.6%	100.0%
EASTERN SENEGAL	70.7%	21.6%	7.7%	100.0%
SINE SALOUM	70.9%	23.0%	6.2%	100.0%
THIES	43.4%	42.0%	14.6%	100.0%

SOURCE: SEE TABII-A

TABII-C: REGIONAL DISTRIBUTION OF CEREALS SUPPLY IN PERCENTAGE BY PRODUCT IN 1983-1985

REGIONS	REGIONAL PRODUCTION				COMMERCIAL IMPORTS					FOOD AID					TOTAL				
	MILLET SORGHUM	MAIZE	PROCESSED RICE	TOTAL CEREALS	MILLET SORGHUM	MAIZE	PROCESSED RICE	WHEAT	TOTAL CEREALS	MILLET SORGHUM	MAIZE	PROCESSED RICE	WHEAT	TOTAL CEREALS	MILLET SORGHUM	MAIZE	PROCESSED RICE	WHEAT	TOTAL CEREALS
CAP VERT	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	68.0%	29.7%	97.7%	0.2%	0.0%	2.1%	0.0%	2.3%	0.2%	0.0%	70.0%	29.7%	100.0%
CASAMANCE	36.1%	18.6%	10.7%	65.4%	5.7%	3.3%	15.1%	1.5%	25.5%	1.2%	1.6%	6.3%	0.0%	9.1%	43.0%	23.5%	32.1%	1.5%	100.0%
DIOURBEL	47.2%	0.0%	0.0%	47.2%	8.2%	0.0%	24.9%	8.2%	41.4%	6.5%	0.0%	0.0%	5.0%	11.4%	61.9%	0.0%	24.9%	13.2%	100.0%
LOUGA	2.4%	0.0%	0.0%	2.4%	5.5%	0.0%	28.1%	6.9%	40.4%	33.4%	0.0%	0.0%	23.8%	57.2%	41.2%	0.0%	28.1%	30.7%	100.0%
FLEUVE	8.6%	1.9%	42.6%	53.1%	2.9%	1.5%	14.0%	7.8%	26.2%	10.5%	7.7%	0.0%	2.5%	20.6%	22.0%	11.1%	56.6%	10.2%	100.0%
EASTERN SENEGAL	39.7%	27.2%	3.9%	70.7%	6.3%	5.1%	8.3%	1.9%	21.6%	1.4%	4.1%	0.0%	2.2%	7.7%	47.4%	36.3%	12.2%	4.1%	100.0%
SINE SALOUM	65.5%	5.3%	0.0%	70.9%	10.5%	0.9%	10.5%	1.1%	23.0%	3.0%	0.0%	0.0%	3.1%	6.2%	79.1%	6.2%	10.5%	4.3%	100.0%
THIES	43.4%	0.0%	0.0%	43.4%	7.7%	0.0%	26.9%	7.4%	42.0%	7.0%	0.0%	0.0%	7.6%	14.6%	58.1%	0.0%	26.9%	15.0%	100.0%

SOURCE: SEE TABII-A

TABIII-A.1: ESTIMATION OF THE CEREALS CONSUMPTION PER CAPITA IN URBAN AND RURAL AREAS BY REGION IN 1977/79

UNITS: KILOS PER CAPITA

REGIONS	MILLET/SORGHUM		RICE		MAIZE		WHEAT		TOTAL		TOTAL IN CPE (1)	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
CAP VERT	16	52	104	120	4	2	69	30	193	204	168	183
CASAMANCE	15	114	130	70	8	19	79	2	192	205	203	175
DIOURBEL	63	161	77	31	5	2	48	11	193	205	164	166
LOUGA	63	161	77	31	5	2	48	11	193	205	164	166
FLEUVE	30	133	82	50	5	16	76	6	193	205	163	170
EASTERN SENEGAL	50	164	100	24	6	15	38	3	194	206	170	166
SINE SALOUM	50	164	100	24	6	15	38	3	194	206	170	166
THIES	63	161	77	31	5	2	48	11	193	205	164	166
TOTAL	32	146	96	42	5	11	59	6	193	205	166	168
WEIGHTED REGIONAL TOTAL	107		60		9		25		201		168	

NOTE: (1) IN ORDER TO GET COMPARABLE QUANTITIES OF EACH CEREAL CONSUMED,
THE GROSS QUANTITIES CONSUMED ARE CONVERTED INTO CONSUMABLE PRODUCT EQUIVALENT
ACCORDING TO THE FOLLOWING COEFFICIENTS: MILLET/SORGHUM AND MAIZE-78% ;WHEAT-70% ;RICE-100%

SOURCE: FAO (1985) APPENDIX F P.24 BASED ON SONED AND ORANA SURVEYS AND THE CEREALS REGIONAL SUPPLY

TABIII-A.2: ESTIMATION DE LA CONSOMMATION DE CEREALES PER CAPITA EN MILIEU URBAIN ET RURAL PAR REGION EN 1982/84

UNITE: KILOS PER CAPITA

REGIONS	MILLET/SORGHUM		RICE		MAIZE		WHEAT		TOTAL		TOTAL IN CPE (1)	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
CAP VERT	16	53	119	135	6	2	63	25	204	215	180	185
CASAMANCE	15	114	142	73	12	26	35	2	204	215	188	184
DIOURBEL	65	162	90	44	5	2	44	7	204	215	175	177
LOUGA	65	162	90	44	5	2	44	7	204	215	175	177
FLEUVE	31	133	99	62	5	16	69	4	204	215	175	181
EASTERN SENEGAL	52	165	109	26	9	22	34	2	204	215	180	173
SINE SALOUM	52	165	109	26	9	22	34	2	204	215	180	173
THIES	65	162	90	44	5	2	44	7	204	215	175	177
TOTAL	33	147	110	51	7	13	54	4	204	215	179	175
WEIGHTED REGIONAL TOTAL	106		72		11		22		211		179	

NOTE: (1) IN ORDER TO GET COMPARABLE QUANTITIES OF EACH CEREAL CONSUMED,
THE GROSS QUANTITIES CONSUMED ARE CONVERTED INTO CONSUMABLE PRODUCT EQUIVALENT
ACCORDING TO THE FOLLOWING COEFFICIENTS: MILLET/SORGHUM AND MAIZE-78% ;WHEAT-70% ;RICE-100%

SOURCE: FAO (1985) APPENDIX F P.24 BASED ON SONED AND ORANA SURVEYS AND THE CEREALS REGIONAL SUPPLY

TABIII-B: REGIONAL CEREALS BALANCE SHEETS ESTIMATED BY PRODUCT (1983-85)

UNITS : TONS OF CONSUMABLE PRODUCT EQUIVALENT

REGIONS	REGIONAL PRODUCTION					REGIONAL CONSUMPTION					REGIONAL BALANCE				
	MILLET/ SORGHUM	MAIZE	RICE	WHEAT	TOTAL CEREALS	MILLET/ SORGHUM	MAIZE	RICE	WHEAT	TOTAL CEREALS	MILLET/ SORGHUM	MAIZE	RICE	WHEAT	NET BALANCE
CAP VERT	0	0	0	0	0	22017	6380	175051	60494	263941	-22017	-6380	-175051	-60494	-263941
CASAMANCE	70320	36249	26774	0	133343	65670	15995	74050	4732	160446	4651	20254	-47275	-4732	-27103
DIOURBEL	33182	0	0	0	33182	40117	1042	27149	5359	73668	-6935	-1042	-27149	-5359	-40486
LOUGA	832	0	0	0	832	39431	1037	26965	5389	72822	-38599	-1037	-26965	-5389	-71991
FLEUVE	7325	1631	46358	0	55313	48659	6037	44749	10143	109588	-41334	-4407	1609	-10143	-54275
EASTERN SENEGAL	24539	16807	3060	0	44406	42229	5710	13526	1617	63082	-17690	11097	-10467	-1617	-18676
SINE SALOUM	175800	14299	0	0	190099	143586	19494	50649	6623	220552	32214	-5195	-50849	-6623	-30453
THIES	46514	0	0	0	46514	62145	2163	53885	13406	131599	-15631	-2163	-53885	-13406	-85085

SOURCES: TABII-A FOR REGIONAL PRODUCTION
TABIII-A.2 FOR PER CAPITA REGIONAL CEREALS CONSUMPTION
DIRECTION DE LA STATISTIQUE FOR REGIONAL POPULATION

NOTES: WEIGHTS IN TONS OF CONSUMABLE PRODUCT EQUIVALENT ARE CALCULATED BY MULTIPLYING WEIGHTS IN TONS BY THE FOLLOWING COEFFICIENTS:
MILLET/SORGHUM AND MAIZE: 78%; WHEAT: 70%; RICE: 100%

TABIV-A: POURCENTAGE OF FARMS SELF-SUFFICIENT IN CEREALS
ACCORDING TO SEVERAL SURVEYS

SOURCE	YEARS OF THE SURVEY	REGION SURVEYED	NUMBER OF FARMS SURVEYED	POURCENTAGE D'EXPLOITATIONS AUTOSUFFISANTES
ROSS (1979)	1977-78	DIOURBEL	30	69
BA (1982)	1979	SINE-SALOUM	177	79
BENOIT-CATTIN (1984)	1981	SINE-SALOUM	10	100
SODEVA QUOTED BY YOUNG (1984)	1981-82	LOUGA	94	
		DIOURBEL	195	
		THIES	179	61
		SINE-SALOUM	189	
JOLLY et al (1984)	1982-83	LOWER CASAMANCE	237	40
JOLLY et al (1984)	1983-84	LOWER CASAMANCE	150	0

TABV-A: PROJECTION OF THE CEREALS BALANCE SHEET BY FAO

TABV-A.1: PROJECTION OF THE DEMAND FOR CEREALS FROM 1982/84 TO 1995

HYPOTHESES:

- FOR THE ANNUAL POPULATION GROWTH RATES, 5.5% IN DAKAR, 4.5% IN THE OTHER CITIES AND 1.97% IN RURAL AREAS, I.E. 3.18% FOR THE TOTAL POPULATION
- FOR THE DEMAND FOR CEREALS IN URBAN AREAS IN 1995, 33 KILOS OF MILLET/SORGHUM, 110 KILOS OF RICE, 7 KILOS OF MAIZE, 54 KILOS OF WHEAT, I.E. 204 KILOS OF CEREALS PER CAPITA
- FOR THE DEMAND OF CEREALS IN RURAL AREAS IN 1995, 147 KILOS OF MILLET/SORGHUM, 51 KILOS OF RICE, 13 KILOS OF MAIZE, 4 KILOS OF WHEAT, I.E. 215 KILOS OF CEREALS PER CAPITA
- FOR THE DEMAND OF CEREALS IN 1982/84, AVERAGE NATIONAL SUPPLY OF CEREALS OVER THREE YEARS (SUM OF PRODUCTION PLUS COMMERCIAL IMPORTS PLUS FOOD AID)

YEARS	URBAN POPULATION (THOUSAND PEOPLE)	RURAL POPULATION (THOUSAND PEOPLE)	TOTAL POPULATION (THOUSAND PEOPLE)	DEMAND FOR CEREALS (THOUSAND TONS)				
				RICE	WHEAT	MAIZE	MILLET SORGHUM	TOTAL
1982/84 (1)	2434	4085	6519	445	133	79 (2)	649	1306
1995	3965	4967	8933	689	234	117 (3)	861	1901

NOTES:

(1) POPULATION FIGURES IN THE LINE 1982/84 ARE FOR 1985
(2) THIS AMOUNT INCLUDES 10000 TONS OF MAIZE FOR ANIMAL FEEDING
(3) THIS AMOUNT INCLUDES 25000 TONS OF MAIZE FOR ANIMAL FEEDING

SOURCES: FAO APPENDIX F TABLE F4 P.24, TABLE F6 P.28 AND TABLE F7 P.30

TABV-A.2: PROJECTION OF THE CEREALS PRODUCTION FROM 1982/84 TO 1995

HYPOTHESES:

- FOR THE RAINFED CULTIVATION OF MILLET/SORGHUM AND MAIZE, 3 LEVELS ARE PROPOSED: F0: PRESENT LEVEL, F1: MODERATE INTENSIFICATION, F2: AVERAGE INTENSIFICATION. GOING TO TO A HIGHER LEVEL OF INTENSIFICATION IMPLIES AN INCREASE IN YIELDS AND CULTIVATED AREAS. THE FORECASTED SCENERIO IS AN OPTIMISTIC SCENARIO WHICH IS BASED ON A MIX OF F0, F1, F2 LEVELS.
- FOR THE CULTIVATION OF RAINFED RICE, LOWLAND RICE, TRANSPLANTED RICE, IRRIGATED RICE ON THE ANAMBE AND THE GAMBIA RIVERS, IRRIGATED MAIZE ON THE ANAMBE RIVER, AN OPTIMISTIC HYPOTHESIS FOR PRODUCTION IS ADOPTED.
- FOR ALREADY CREATED PERIMETERS IN THE FLEUVE REGION, YIELD OF 6 TONS PER HECTARE; CULTURAL INTENSITY COEFFICIENT OF 1.8 (O/W 1,5 OF RICE AND 0.2 OF MAIZE FOR SAED PERIMETERS AND 1.6 OF RICE FOR THE OTHER PERIMETERS)
- FOR THE NEW PERIMETERS TO CREATE IN THE FLEUVE REGION, VERY OPTIMISTIC HYPOTHESES ARE ALSO ADOPTED: 3800 HECTARES TO BE CREATED ANNUALLY (O/W 300 FOR TOMATO); AVERAGE YIELD OF 5 TONS PER HECTARE FOR RICE AND 4.5 TONS FOR MAIZE; CULTURAL INTENSITY COEFFICIENT OF 1.68 (1,5 OF RICE AND 0,18 OF MAIZE). THE NUMBER OF HECTARES TO CREATE IS CALCULATED SO THAT THE CEREALS SELF-SUFFICIENCY LEVEL IS 75% IN COMPLIANCE WITH THE GOUVERNEMENT'S OBJECTIVES.

CROP	AVERAGE PRODUCTION 1982/84 (THOUSAND TONS)	AREA 1995 (THOUSAND HECTARES)	YIELD 1995 (1) (KGS/HA)	PRODUCTION 1995 (2) (THOUSAND TONS)
MILLET/SORGHUM	577			656
- RAINFED MAIZE				284
- IRRIGATED MAIZE (ANAMBE)				6
- IRRIGATED MAIZE (FLEUVE; EXISTING PERIMETERS IN 1984)		24.5	100 (3)	22
- IRRIGATED MAIZE (FLEUVE; NEW PERIMETERS)		35	810 (4)	25.5
TOTAL MAIZE	72			337.5
- RAINFED RICE		5	650	3
- LOWLAND RICE		20	1300	26
- FRESH WATER AQUATIC RICE		30	1625	49
- MANGROVE RICE		4	975	4
- IRRIGATED RICE:				
- ANAMBE		5	3900	19.5
- GAMBIA		0.6	5200	3.1
- IRRIGATED RICE (FLEUVE; EXISTING PERIMETERS):				
-SAED		24.5	6240 (5)	153
-OTHERS		1.5	7020 (6)	11
- IRRIGATED RICE (FLEUVE; NEW PERIMETERS)		35	4375 (7)	171
TOTAL RICE	66			439.6
TOTAL CEREALS	715			1433.1

NOTES: (1) THE YIELD FOR RICE IS IN PROCESSED RICE USING A PROCESSING RATE OF 65%
(2) THE PRODUCTION OF MILLET/SORGHUM AND MAIZE IS NET OF LOSSES ESTIMATED AT 10% OF GROSS PRODUCTION
(3) CULTURAL INTENSITY COEFFICIENT OF 0.2; YIELD OF 5 TONS/HA
(4) CULTURAL INTENSITY COEFFICIENT OF 0.18; YIELD OF 4.5 TONS/HA
(5) CULTURAL INTENSITY COEFFICIENT OF 1.6; YIELD OF 6 TONS/HA FOR THE SAED PERIMETERS
(6) CULTURAL INTENSITY COEFFICIENT OF 1.8; YIELD OF 6 TONS/HA FOR THE OTHER EXISTING PERIMETERS
(7) CULTURAL INTENSITY COEFFICIENT OF 1.5; YIELD OF 5 TONS/HA FOR THE NEW PERIMETERS

SOURCES: FAO APPENDIX 0 TABLE 06 P.21, APPENDIX I PP. 7,18,19,26,27,64

TABV-A.3: PROJECTION OF THE CEREALS BALANCE SHEET FROM 1982/84 TO 2005

UNITS: THOUSAND TONS

CEREALS	1982/84				2005			
	DEMAND	PRODUCTION	BALANCE (1)	LEVEL OF SELF SUFFICIENCY	DEMAND	PRODUCTION	BALANCE (1)	LEVEL OF SELF SUFFICIENCY
RICE	445	66	-379	15%	689	440	-249	64%
MILLET/ SORGHUM	649	577	-72	89%	861	656	-205	76%
WHEAT	133	0	-133	0%	234	0	-234	0%
MAIZE	79 (2)	715	-7	91%	117 (2)	337	220	288%
TOTAL	1306	715	-591	55%	1901	1433	-468	75%

NOTES: (1) THE BALANCE IS THE DIFFERENCE BETWEEN PRODUCTION AND DEMAND.
A NEGATIVE BALANCE IS A DEFICIT; A POSITIVE BALANCE A SURPLUS
(2) INCLUDES 10000 TONS OF MAIZE FOR ANIMAL FEEDING

SOURCES: FAO APPENDIX 0 TABLE 06 P.21, APPENDIX I PP.7,18,19,26,27,64

TABV-B: PROJECTION OF THE GRAIN BALANCE SHEET IN THE ABT ASSOCIATES REPORT

TABV-B.1: PROJECTION OF THE DEMAND FOR GRAINS FROM 1985 TO 2000

HYPOTHESES: - ANNUAL GROWTH RATE OF 2.4% FOR THE RURAL POPULATION AND OF 3.7% FOR THE URBAN POPULATION
- DEMAND FOR PROCESSED GRAINS (MILLET/SORGHUM, MAIZE, COWPEAS) PER CAPITA OF 247.8 KGS IN RURAL AREAS AND OF 119.3 KGS IN URBAN AREAS

UNITS: POPULATION : MILLION PEOPLE
DEMAND : THOUSAND TONS

YEARS	URBAN POPULATION	RURAL POPULATION	TOTAL POPULATION	GRAINS DEMAND
1985	4.38	2.12	6.50	1338.30
1990	4.92	2.54	7.46	1522.20
1995	5.52	3.05	8.57	1731.80
2000	6.19	3.65	9.84	1969.30

SOURCE: ABT ASSOCIATES TABLE 3-15

TABV-B.2: PROJECTION OF THE GRAINS PRODUCTION FROM 1985 TO 2000

HYPOTHESES: - FOR MILLET/SORGHUM, DECREASE OF 102400 HECTARES FROM 1985 TO 2000, I.E. -6287 HA/YEAR; YIELD INCREASE OF 1% ANNUALLY
- FOR MAIZE, INCREASE OF 75000 HECTARES FROM 1995 TO 2000, I.E. +5000HA/YEAR; YIELD INCREASE OF 3.5% ANNUALLY
- FOR TRADITIONALLY CULTIVATED RICE (RAINFED, LOWLAND AND TRANSPLANTED), DECREASE OF 5500 HECTARES FROM 1985 TO 2000, I.E. -1% ANNUALLY; YIELD UNCHANGED
- FOR IRRIGATED RICE, INCREASE OF 7500 HECTARES FROM 1985 TO 2000, I.E. + 5000HA/YEAR YIELD INCREASE OF 3% ANNUALLY
- FOR COWPEAS, INCREASE OF 32300 HECTARES FROM 1988 TO 2000, I.E. +2475 HA/YEAR YIELD INCREASE OF 2% ANNUALLY FROM 1988 TO 1989 AND 5% THEREAFTER.

UNITS: A = AREA (THOUSAND HECTARES)
Y = YIELD (KILOS/HECTARE)
P = PRODUCTION (THOUSAND TONS)

CROP	1985			1990			1995			2000		
	A	Y	P	A	Y	P	A	Y	P	A	Y	P
- MILLET/SORGHUM	1000	470	470	873	493	479	935	517	483	898	540	485
- MAIZE	75	721	54	100	866	87	125	1010	126	150	1154	173
- RAINFED, LOWLAND AND TRANSPLANTED RICE	37	498	18	35	498	18	33	498	17	32	498	16
- IRRIGATED RICE	33	1412	47	58	1624	94	83	1835	152	108	2048	221
- TOTAL RICE	70		65	93		112	116		169	140		237
TOTAL CEREALS	1145		589	1066		678	1176		778	1188		895
COWPEAS	40	288	12	48	315	15	60	402	24	72	513	37
TOTAL GRAINS	1185		601	1114		693	1236		802	1260		932

SOURCE: ABT ASSOCIATES TABLES 3-13, 3-14, 3-15

TABV-B.3: PROJECTION OF THE GRAINS BALANCE SHEET FROM 1985 TO 2000

UNITS: THOUSAND TONS

YEARS	DEMAND	PRODUCTION	DEFICIT	LEVEL OF SELF SUFFICIENCY
1985	1338	600	738	45.0%
1990	1522	693	829	46.0%
1995	1732	802	930	46.0%
2000	1969	932	1037	47.0%

SOURCE: ABT ASSOCIATES TABLE 3-15

TABV-C: PROJECTION OF THE CEREALS BALANCE SHEET BY THE "SCHEMA NATIONAL D'AMENAGEMENT DU TERRITOIRE"

TABV-C.1: PROJECTION OF THE DEMAND FOR CEREALS FROM 1980 TO 2005

HYPOTHESES: - FOR THE POPULATION GROWTH, SLOW DECREASE OF MORTALITY, SLOW DECREASE OF FECONDITY AND SLOW EVOLUTION OF THE SOCIO-ECONOMIC SITUATION - AVERAGE GROWTH RATE OF 3% PER YEAR
- DEMAND FOR CEREALS IN 1980: 90.4 KGS OF RICE, 19.5 KGS OF WHEAT, 11.7 KGS OF MAIZE 98.9 KGS OF MILLET/SORGHUM, I.E. 220.5 KGS OF CREALS PER CAPITA.
- DEMAND OF CEREALS IN 2005: 83.6 KGS OF RICE, 17.4 KGS OF WHEAT, 10.9 KGS OF MAIZE, 99.1 KGS OF MILLET, I.E. 211 KGS OF CEREALS PER CAPITA. CONSUMPTION IN 2005 ASSUMES A FALL OF PER CAPITA INCOME OF 0.5% AND THE FOLLOWING PRICE-ELASTICITIES OF DEMAND: 0.4 FOR RICE, 0.7 FOR WHEAT, 0.3 FOR MAIZE ET -0.2 FOR MILLET.

YEARS	POPULAT (THOUSA PEOPLE)	DEMAND FOR CEREALS (THOUSAND TONS)				
		RICE	WHEAT	MAIZE	MILLET SORGHUM	TOTAL
1980	5625	508.5	109.9	65.7	556.1	1240.2
2005	12373	1034.1	214.8	135.3	1226.6	2610.8

SOURCE: SECRETARIAT D'ETAT CHARGE DE LA DECENTRALISATION (1984) P.117, P.251

TABV-C.2: PROJECTION OF THE CEREALS PRODUCTION FROM 1980 TO 2005

HYPOTHESES: - FOR MILLET/SORGHUM, PRODUCTION GROWTH RATE OF 2.5% ANNUALLY
- FOR RICE, PRODUCTION GROWTH RATE OF 6.0% ANNUALLY
- FOR MAIZE, PRODUCTION GROWTH RATE OF 3.8% ANNUALLY

UNITS: PRODUCTION: THOUSAND TONS
AREA: THOUSAND HECTARES
YIELD: KILOS/HA

CROP	AVERAGE PRODUCTIO AROUND 19	AREA 2005	YIELD 2005	PRODUCTION 2005
MILLET/SORGHUM	600	1430	700	1000
RICE	100			450
O/W:				
-DELTA SENEGAL RIVER		20	3000	60
-SENEGAL RIVER VALLEY		40	5600	225
-CASAMANCE		100	1500	150
-OTHERS				15
MAIZE	47	140	900	125
TOTAL	747			1575

SOURCE: SECRETARIAT D'ETAT CHARGE DE LA DECENTRALISATION (1984) P.254

TABV-C.3: PROJECTION OF THE CEREALS BALANCE SHEET FROM 1980 TO 2005

UNITS: THOUSAND TONS

CROP	1980				2005			
	DEMAND	PRODUCTION	BALANCE (1)	LEVEL SELF SUFFICIENCY	DEMAND	PRODUCTION	BALANCE (1)	LEVEL SELF SUFFICIENCY
RICE	508	100	-408	19.7%	1034	450	-584	43.5%
MILLET/SORGHUM	556	600	44	107.9%	1227	1000	-227	81.5%
WHEAT	110	0	-110	0.0%	215	0	-215	0.0%
MAIZE	66	47	-19	71.2%	135	125	-10	92.6%
TOTAL	1240	747	-493	60.2%	2611	1575	-1036	60.3%

NOTES: (1) THE BALANCE IS THE DIFFERENCE BETWEEN PRODUCTION AND DEMAND.
A NEGATIVE BALANCE IS A DEFICIT; A POSITIVE BALANCE IS A SURPLUS

SOURCE: SECRETARIAT D'ETAT CHARGE DE LA DECENTRALISATION P.254

TABVI-A: EVOLUTION OF THE COEFFICIENTS OF VARIATION FOR THE WORLD PRICES OF SELECTED AGRICULTURAL PRODUCTS (1970-1984)

PRODUCT	DENOMINATION	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	AVERAGE	STANDARD DEVIATION	COEF. OF VARIATION
RICE (1)	U.S. DOLLARS	144	129	147	350	342	363	255	272	368	334	434	483	293	277	257	310	116	0.38
	CFA FRANCS	40032	35733	37044	78050	130622	77703	60826	66561	83055	71185	91353	131322	94607	105499	112353	81103	29730	0.37
WHEAT (2)	U.S. DOLLARS	55	62	70	140	180	149	133	103	128	160	173	175	160	157	153	133	40	0.30
	CFA FRANCS	15290	17174	17640	31220	43380	31886	31787	25338	28928	34080	36503	47600	51680	59817	66861	35946	14833	0.41
SORGHUM (3)	U.S. DOLLARS	52	56	56	93	121	112	105	88	94	108	129	126	109	123	121	100	26	0.26
	CFA FRANCS	14400	15489	14112	20739	29161	23947	25143	21746	21139	23025	27138	34381	35046	49073	52877	27165	11160	0.41
MAIZE (4)	U.S. DOLLARS	58	58	56	98	132	120	112	95	101	116	125	131	108	136	136	105	27	0.26
	CFA FRANCS	16124	16066	14112	21854	31812	25680	26768	23370	22826	24708	26375	35632	34884	51816	53432	28764	12245	0.43
SHELLED GROUNDNUT (5)	U.S. DOLLARS	228	251	254	391	739	433	423	547	631	563	486	623	383	349	350	443	147	0.33
	CFA FRANCS	63384	69527	64008	87193	178099	92662	101097	134562	142606	119919	102546	169456	123709	132369	132950	115646	35498	0.31
GROUNDNUT MEAL (6)	U.S. DOLLARS	102	98	122	266	174	140	176	218	205	211	241	239	169	196	158	182	49	0.27
	CFA FRANCS	28356	27146	30744	59318	41934	29960	42064	53628	46330	44943	50851	65008	61047	74676	69046	48337	14851	0.31
GROUNDNUT OIL (7)	U.S. DOLLARS	379	441	426	546	1077	778	691	846	1079	889	859	1043	585	711	1017	758	235	0.31
	CFA FRANCS	105251	122074	107327	121803	259509	166492	165149	208116	243899	189293	181207	283696	188923	270853	444429	203868	85542	0.42
COTTON (8)	U.S. DOLLARS	138	136	144	224	339	285	301	333	296	338	338	335	275	307	360	277	76	0.27
	CFA FRANCS	38364	37672	36162	49907	81603	61054	71315	82016	66806	72058	71237	91147	88954	117043	157451	74897	30856	0.41

NOTES:
(1) 100% BROKEN RICE PRICE CIF DAKAR PAID BY THE CPSP, THE PARASTATAL IN CHARGE OF IMPORTING RICE
(2) U.S. WHEAT, GULF PORTS
(3) U.S. SORGHUM # 2 MILO YELLOW, FOB GULF PORTS
(4) U.S. MAIZE # 2 YELLOW, FOB GULF PORTS
(5) SHELLED GROUNDNUT FROM NIGERIA, CIF EUROPEAN PORTS
(6) ORIGIN: NIGERIA, PRICE ON THE LONDON MARKET
(7) ORIGIN: NIGERIA, GAMBIA, OTHER ORIGINS 3-5% IN BULK, CIF EUROPEAN PORTS
(8) EGYPTIAN COTTON, CIF LIVERPOOL

SOURCES:
F.MARTIN (1986) LA REFORME DE LA POLITIQUE CEREALIERE DANS LE SAHEL - LE SENEGAL, CILSS-CLUB DU SAHEL-ELLIOT BERG ASSOCIATES, TABLES 24 TO 28 FOR THE WORLD PRICES OF RICE, WHEAT, SORGHUM, MAIZE AND GROUNDNUT PRODUCTS

BANQUE MONDIALE (1985) COMMODITY TRADE AND PRICE TRENDS FOR THE PRICE OF COTTON

TABVI-B: COEFFICIENTS OF VARIATION FOR YIELDS IN SENEGAL (1970-85)

AREA	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	AVERAGE	STANDARD DEVIATION	COEF. OF VARIATION
SENEGAL																			
MILLET/SORGHUM	612	395	601	344	460	700	640	535	445	760	540	490	830	590	425	458	552	131	0.24
MAIZE	883	652	770	623	960	890	885	835	615	960	685	730	1219	950	859	1191	860	174	0.20
PADDY RICE	1351	1043	1280	711	1005	1410	1390	1420	995	1605	1225	960	1675	1395	1974	2055	1343	353	0.26
COWPEAS	316	281	365	125	287	395	408	256	205	292	339	315	420	250	234	308	300	75	0.25
GROUNDNUT	819	554	929	532	640	930	1095	855	440	910	640	490	850	995	530	779	749	197	0.26
COTTON	1172	852	1154	1145	1160	1070	785	1030	790	700	870	700	1280	1120	1110	1284	1014	193	0.19
CASAMANCE																			
MILLET/SORGHUM	779	1002	812	986	789	843	1067	817	833	740	298	779	565	804	949	1042	819	183	0.22
MAIZE	953	734	831	746	986	1078	1096	1213	713	838	911	783	801	894	1034	1527	946	205	0.22
PADDY RICE	1248	919	1118	791	990	1354	1374	1358	814	1510	983	550	1348	1095	1129	933	1095	253	0.23
COWPEAS	444	391	301	200	379	510	433	402	386	495	266	347	463	503	483	688	418	110	0.26
GROUNDNUT	776	997	1031	1148	1055	943	1081	1156	858	1008	840	472	1099	1256	1180	1222	1008	132	0.19
COTTON	1506	1303	1321	1449	1449	1084	665	1160	1168	755	993	779	686	1355	1120	792	1099	281	0.26
DIOURBEL																			
MILLET/SORGHUM	511	269	597	423	400	639	529	623	253	794	555	363	555	447	542	542	503	135	0.27
COWPEAS	194	252	283	286	339	337	445	400	310	560	614	189	552	275	0	187	326	155	0.47
GROUNDNUT	536	311	851	338	530	851	1194	978	492	870	713	306	931	697	336	769	669	263	0.39
																	0	0	
LOUGA																			
MILLET/SORGHUM	337	210	462	60	240	526	498	301	203	550	330	427	284	283	124	33	304	154	0.51
COWPEAS	287	230	367	116	290	438	497	205	218	428	352	370	400	233	225	370	314	101	0.32
GROUNDNUT	804	248	918	94	505	742	1009	600	273	958	420	717	850	782	157	1313	649	332	0.51

SOURCE: DIRECTION DE L'AGRICULTURE

TABVI-8: COEFFICIENTS OF VARIATION FOR YIELDS IN SENEGAL (1970-85) (CONTINUED)

AREA	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	AVERAGE	STANDARD DEVIATION	COEF. OF VARIATION
FLEUVE																			
MILLET/SORGHUM	612	318	417	22	317	441	434	231	113	410	312	323	474	140	284	355	325	143	0.44
MAIZE	686	631	653	500	587	740	0	0	480	732	1250	797	682	375	424	2160	663	481	0.72
PADDY RICE	1962	1456	2385	565	1225	1830	1238	2178	2218	2884	3143	3258	3583	3365	4330	4773	2525	1133	0.45
SENEGAL ORIENTAL																			
MILLET/SORGHUM	785	382	754	545	454	611	861	308	584	869	446	641	845	849	512	706	635	177	0.28
MAIZE	879	536	768	544	818	779	863	456	475	922	682	568	2308	1076	630	900	825	421	0.51
PADDY RICE	1059	737	977	875	1200	1623	1769	1155	919	1114	842	800	3368	952	769	1028	1199	625	0.52
GROUNDNUT	862	384	740	642	464	1044	985	1189	787	1023	601	469	923	914	525	1006	785	238	0.30
COTTON	1110	712	1200	1053	1054	1071	877	960	576	672	799	610	1126	905	0	1077	863	293	0.34
SINE SALOUM																			
MILLET/SORGHUM	631	465	618	440	468	787	683	710	498	809	585	575	712	651	483	594	607	112	0.18
MAIZE	857	667	857	500	1429	1667	1931	1264	781	1426	191	800	1909	1085	556	930	1053	493	0.47
GROUNDNUT	957	670	911	754	648	1010	1150	977	419	784	683	509	835	1110	586	1046	816	212	0.26
COTTON	1038	734	824	784	704	1027	838	880	329	606	799	635	1066		559	950	785	194	0.25
THIES																			
MILLET/SORGHUM	471	219	506	85	589	676	763	406	211	1070	548	422	722	687	334	400	507	238	0.47
COWPEAS	257	242	281	95	310	433	361	235	213	250	220	251	410	400	226	181	273	87	0.32
GROUNDNUT	758	531	1088	118	611	975	977	747	244	1297	656	342	693	990	556	1201	736	327	0.44

SOURCE: DIRECTION DE L'AGRICULTURE

TABVII-A: TRADE BALANCE FOR AGRICULTURAL PRODUCTS PROJECTED FROM 1985 TO 2000 BY THE ABT ASSOCIATES REPORT

UNITS: BILLIONS OF CONSTANT CFAF OF 1985

CATEGORY	1985	1990	1995	2000
EXPORTS				
. GROUNDNUT PRODUCTS	56	56	56	56
. COTTON	8	8	8	8
. TOTAL	64	64	64	64
IMPORTS				
. RICE	39.2	44.1	49.4	55.2
. WHEAT	8.8	10	11.1	12.4
. SUGAR	2.7	3.1	3.6	4.2
. OTHERS	30	34.2	40	46.4
. TOTAL	80.7	91.4	104.1	118.2
BALANCE	-16.7	-27.4	-40.1	-54.2

SOURCE: ABT ASSOCIATES (1984) TABLE 3.5

TABVII-B: TRADE BALANCE OF AGRICULTURAL PRODUCTS PROJECTED FROM 1982 TO 1992 BY THE SENEGALESE GOVERNMENT

UNITS: BILLIONS OF CONSTANTS CFAF OF 1982

CATEGORY	1982	1985	1990	1992
EXPORTS				
. GROUNDNUT PRODUCTS	54	47.3	47.3	47.3
. COTTON	5.5	5	6.6	7.5
. TOTAL	59.5	52.3	53.9	54.8
IMPORTS				
. RICE	24.7	26.3	26.3	26.3
. WHEAT	5.6	5.9	5.9	5.9
. TOTAL	30.3	32.2	32.2	32.2
BALANCE	29.2	20.1	21.7	22.6

SOURCE: GOUVERNEMENT DU SENEGAL (1984) P.112