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An Analysis of Constraints on
Expanding Rice Output in the
Casamance Region of Senegal
by
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FOREWORD

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The primary mission of the African Rural Economy Program is to further comparative analysis of the development process in Africa with emphasis on both micro and macro level research on the rural economy. The research program is carried out by faculty and students in the Department of Agricultural Economics in cooperation with researchers in African universities and government agencies. Specific examples of ongoing research are, "Poor Rural Households, Income Distribution and Technical Change in Sierra Leone and Nigeria," "Rural and Urban Small-Scale Industry in West Africa," "Dynamics of Female Participation in the Economic Development Process in West Africa," and "The Economics of Small Farmer Production and Marketing Systems in the Sahelian Zone of West Africa".

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AN ANALYSIS OF CONSTRAINTS ON EXPANDING RICE OUTPUT IN THE CASAMANCE REGION OF SENEGAL*

by

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ABSTRACT

AN ANALYSIS OF CONSTRAINTS ON
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Senegal imports about 200,000 tons of rice annually. These imports consume a large share of the national budget and represent a heavy outflow of foreign exchange. Despite the implementation of various agricultural projects aimed at increasing domestic rice production, Senegal still relies on imports to fill its deficit and there is no evidence that the situation will change in the near future.

The purpose of this paper is to identify and analyze selected factors which are believed to impede expansion of rice production in the Casamance (southern) Region of Senegal. The following factors are studied:

1.) climatic uncertainties (effects of the drought).

2.) the competition between groundnuts and rice for the allocation of family labor.

3.) the institutional constraints upon the marketing system in general, and processing in particular.

4.) the effects of migration.

The results of this analysis suggest that results from the present rice production-marketing subsystem could be significantly improved if more consistent price and marketing policies were defined and applied, and if production and credit were reorganized.

ACKNOWLEDGMENT

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A. Background and Purpose of the Study

Agriculture still remains the most important sector of the Senegalese economy. Over 70% of the 5.1 million Senegalese live in rural areas with agriculture as their primary activity. Although Senegalese agriculture is d versified, it is still dominated by groundnuts, around which most of the country's economic activities evolve.

Because of the competitive advantage of groundnuts over other crops in the allocation of available resources, groundnut production in Senegal has exhibited a fluctuating but positive trend since 1968. Groundnut acreage has risen from 1,191,000 ha in 1968 to 1,330,000 ha in 1977, with production rising from 831,000 tons to 1,195,000 tons. As a result of this specialization in groundnut production, Senegal has relied heavily on imported food grains, particularly rice, to satisfy local demand for cereals.

Millet and sorghum are grown throughout the entire country and their production increased from 450,000 tons in 1968 to 952,000 tons in 1977. This increase in production has been accomplished in spite of a slight decrease in acreage caused by the competition between groundnuts and these crops with regard to the allocation of inputs.

Rice also is very important in the Senegalese diet, but it is the "problematic cereal" in the sense that estimated production of paddy in 1981--about 93,000 tons--will barely cover 25% of projected 1981 consumption. Current imports of rice average 150,000 tons per year.

The food situation in Senegal has been deteriorating in recent years because of the high profitability of groundnuts and recurrent drought in the Sahel. This declining availability of locally produced foodstuffs has moved the Senegalese government to rank food self-sufficiency as the "priority of the priorities" in most recent development plans. Ambitious projects hope to increase rice production to 300,000 tons by improving water control and cultivation technologies and thereby to eliminate the imports.

Despite real efforts which have been made to increase rice production in Senegal, the level of production remains relatively constant. The purpose of this paper is to identify some of the major obstacles that impede the achievement of rice self-sufficiency in the Casamance Region of Senegal, which accounts for 80% of Senegal's rice production, and to suggest ways of overcoming these obstacles.

B. The Overall Food Situation in Senegal

Table 1 presents average acreage, yields, and production in Senegal for the period 1968-1977. Table 2 gives the share of cereal consumption supplied by local production during the period 1960 to 1977. Based on the population growth rate and trends in production and consumption, SONED projects that Senegal will be importing about 553,300 tons of cereals in 1981 (Table 3).

On the basis of the aggregate consumption data contained in Table 2, there has been a food deficit averaging 34% of total cereal consumption during the past decade. This has been met mostly through commercial imports, with about 25% of the deficit being covered by food aid.

In 1976 rice accounted for 47% of total cereals imports by weight. By 1981, rice is expected to account for 59% of total cereals imports (12).

Although the Casamance has been the focal point of major agricultural projects aimed at increasing the domestic production of rice since 1964, this region is expected to remain a net importer of rice in 1981, as can be seen from Table 3. In the remainder of this paper, we will analyze those factors which we believe to be at the source of this paradoxical situation in order to help the reader understand the broader causes of the deteriorating food situation in Senegal.

Table 1

Production ("P" in 1000 tons), Acreage ("A" in 1000 ha) and Yields ("Y" in kilos) of Major Crops in Senegal (1968-77)

	Groundnuts	Millet/ Sorghum	Rice (Paddy)	Maize	Cotton
1976/77					
A	1330	952	81	47	44
P	1195 a)	554	112	47	45
Y	NA	NA	NA	NA	NA
1975/76					
A	1017	900	80	46	43
P	1170	715	140	45	43
Y	NA	NA	NA	NA	NA
1974/75					
A	1152	1155	86	49	39
P	993	777	117	43	42
Y	862	673	1366	888	1098
1973/74					
A	1026	1093	65	39	29
P	677	511	66	34	33
Y	657	467	996	862	1155
1972/73					
A	1071	936	50	32	20
P	570	323	44	20	23
Y	432	344	866	625	1154
1971/72					
A	1060	975	84	49	18
P	988	583	108	38	21
Y	932	597	1242	787	1155
1970/71					
A	983	972	93	51	14
P	583	401	99	39	12
Y	593	412	1058	765	830
1969/70					
A	993	1037	104	55	10
P	779	637	141	69	12
Y	827	612	1349	881	1172
1968/69					
A	1191	1051	77	36	7
P	831	450	79	25	10
Y	698	427	1317	696	1458

Source: Center for Research in Economic Development (2).

a) Not Available

Table 2

Cereal Balances (1000 tons) in Senegal, 1960-77

	Millet/ Sorghum	Rice[a]	Maize	Wheat	Total
1976/77					
DP	554	73	47	0	674
CI	70[b]	130[c]	NA	NA	NA
FA	NA	NA	NA	NA	54[d]
Total	624				
1975/76					
DP	715	91	45	0	851
CI	43	130	0	105	278
FA	NA	0	NA	0	30*
Total	758	221	45	105	1159
1974/75					
DP	777	76	43	0	896
CI	5	124	0	94	223
FA	0	0	5	6	12
Total	782	200	48	100	1131
1973/74					
DP	511	41	34	0	372
CI	34	141	0	81	257
FA	22	2	28	5	57
Total	567	184	62	86	686
1972/73					
DP	323	28	20	0	371
CI	26	188	0	62	277
FA	15	3	46	43	108
Total	364	219	66	105	756
1970/71					
DP	401	64	39	0	504
CI	28	187	0	112	328
FA	1	0	2	0	2
Total	430	251	41	112	834
1960/70					
DP	635	91	49	0	776
CI	0	110	0	108	219
FA	0	8	10	4	22
Total	635	209	59	112	1017

Source: CRED (2)
DP = Domestic Production; CI = Commercial Imports; FA = Food Aid; NA = Not Available; * = Estimate.

a) The local rice figures represented in Table I have been multiplied by .65, representing the percentage of edible rice after transformation; b) under discussion with Argentina; c) minimum consumption; d) committed as of Feb. 1, 1977.

Table 3

Expected Levels of Domestic Demand for and Supply of Cereals in Senegal, 1980-81 (1000 tons)

REGIONS	MILLET/SORGHUM			PADDY			MAIZE			WHEAT			TOTAL CEREALS		
	CONS	DS	DIF	CONS	DS	DIF	CONS	DS	DIF	CONS	DS	DIF	CONS	DS	DIF
CAP-VERT	43.5	0.8	- 42.7	178.8	-	-178.8	4.6	-	- 4.6	77.9	-	- 77.9	304.8	0.8	-304.0
CASAMANCE	86.4	95.8	+ 9.4	91.5	57.8	- 33.7	13.4	15.8	+ 2.4	6.0	-	- 6.0	197.3	169.4	- 27.9
DIOURBEL	66.6	54.6	- 12.0	15.8	-	- 15.8	0.4	-	- 0.4	3.7	-	- 3.7	86.5	54.6	- 31.9
LOUGA	70.4	46.2	- 24.2	9.3	-	- 9.3	0.2	-	- 0.2	1.5	-	- 1.5	81.4	46.2	- 35.2
FLEUVE	58.7	33.6	- 25.1	35.0	27	- 8.0	6.5	6.3	- 0.2	10.4	-	- 10.4	110.6	66.9	- 43.7
SENEGAL/ ORIEN	46.9	48.7	+ 1.8	8.7	7.0	- 1.7	8.8	23.7	+14.9	1.7	-	- 1.7	66.1	79.4	+ 13.3
SINE-SALOUM	180.6	198.2	+ 17.6	51.1	0.7	- 50.4	1.5	7.9	+ 6.4	6.1	-	- 6.1	239.3	206.8	- 32.5
THIES	111.9	61.3	- 50.6	27.8	0.4	- 27.4	1.5	-	- 1.5	11.9	-	- 11.9	153.1	61.7	- 91.4
TOTAL	665.0	539.2	-125.8	418.0	92.9	-325.1	36.9	53.7	+16.8	119.2	-	-119.2	1239.1	685.8	-553.3
IMPORTS (-)	-125.8			-325.1 (Paddy			+16.8			-119.2			-553.3		
EXPORTS (+)				-201.7 (Milled Rice)											

Source: SONED (12).

CONS = Consumption, DS = Domestic Supply; DIF = Difference.

II. THE CASAMANCE REGION

A. Geography

The Casamance is the southernmost region of Senegal. It has long been the most agriculturally underutilized region of the country. The region's agriculture is diversified and accounts for 80% of domestically produced rice. The region covers 28,319 km^2 and is divided into three ecological zones: the Lower, Middle and Upper Casamance, so-called because of the following social and climatic characteristics:

1. Lower Casamance
   --Main ethnic group - Diola
   --Average rainfall = 1500 - 1700 mm/year
   --Principal crop - Swamp rice, fruits.

2. Middle Casamance
   --Main ethnic group - Manding
   --Average rainfall = 1200 - 1400 mm/year
   --Principal crops - groundnuts, upland rice, millet/sorghum.

3. Upper Casamance
   --Main ethnic group - Peulh
   --Average rainfall = 900 - 1100 mm/year
   --Principal crops - groundnuts, cotton, maize, millet/sorghum.

Dry lands for production of peanuts, cotton, millet, sorghum and maize are plentiful but swamp lands for production of rice are scarce because of population pressure, especially in the Lower Casamance (5).

B. Population

Casamance has 729,953 inhabitants. The population is growing at an annual rate of 2.2 percent and is basically young: 42 percent of the total

population is less than 15 years old. The population is also characterized by ethnic diversity, though four dominant ethnic groups account for 87 percent of the population. They are:

Diola - 36.5%

Peulh - 29%

Manding - 14.7%

Balante - 6.5%

The Diola are mainly known for their particular dexterity and skills in rice cultivation while the Manding and Peulh devote themselves more to cash crops (groundnuts, cotton) and animal husbandry.

The rural labor force comprises 273,928 individuals among whom 61 percent are male. However, not all these workers are occupied during the dry season. In fact, it is estimated that about 57 percent of the rural labor force is underutilized or not utilized at all during the dry season (5). This may explain why migration is so important in Casamance, especially in Lower Casamance.[1]

C. Agriculture

Agriculture is the most important economic activity of the region. The farming patterns are still mainly traditional/subsistence. Family labor is by far the most important input, and farmers produce first to feed themselves and their families. However, this situation is changing due to the intervention of various extension organizations emphasizing expansion of cash crops such as groundnuts and cotton. Agricultural production is diversified as shown in Table 4.

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[1] According to SOMIVAC, the World Bank has estimated that out-migration from the Casamance has grown at an annual rate of 7.9 percent between 1960 and 1970. Projecting this rate, we would estimate that in 1976, 79,000 migrants left the Casamance Region. Eighty percent of these departed from Lower Casamance (11).

Table 4

Acreage, Yields and Production of
Major Crops in the Casamance in 1978

	Rice (paddy)	Millet/Sorghum	Maize	Groundnuts	Cotton
Acreage (hectares)	62,490	105,990	18,036	120,320	14,950
Yield (ton/ha)	1.21	.90	.96	1.08	1.09
Production (tons)	75,860	95,580	17,341	129,611	16,280

Source: SOMIVAC (11).

To these principal crops, we should add the secondary crops: manioc, vegetables, fruits (pineapple, mango), etc., which are mostly home-consumed.

The preeminence of groundnuts is evidenced by the large proportion of the total area devoted to this crop. However, the area planted to cereals is much larger than that planted to groundnuts and cotton. This situation has led some people to identify Casamance as the "granary" of Senegal.

Almost all agricultural operations in the Casamance are performed with hand tools; the use of ox-drawn tools, although a favorite theme of extension organizations, is still mainly limited to the groundnut and cotton plots of Middle and Upper Casamance. Moreover, these cash crops also are the crops which get most of the fertilizers, though we hasten to add that use of chemical fertilizers is very low, averaging only 26.5 kg/ha[2] (9). This compares with the minimum requirements recommended by extension organizations (SOMIVAC, SODEFITEX, PRS, PIDAC, etc.) for one hectare of groundnuts and rice, 150 kilos and 350 kilos respectively.

[2]Most of this amount--about 60%--goes to cotton; 30% goes to peanuts and the rest is shared by cereals (rice, millet/sorghum and maize).

D. Obstacles to Self-Sufficiency in Rice

The barriers to reaching self-sufficiency in rice production in the Casamance can be categorized according to their causes:

-- physical causes (climate, geography)

-- institutional causes (marketing system, research, extension and credit)

-- social causes (migration, education)

-- economic causes (incentives, marketing and processing restrictions).

We examine each of these in turn in the body of this paper. We then go on to compare the cost of alternative systems for producing, processing and marketing rice in the Casamance. Finally, we examine the comparative advantage to Senegal of producing rice versus peanuts in the Casamance.

III. PHYSICAL AND INSTITUTIONAL OBSTACLES TO INCREASING PRODUCTION IN CASAMANCE

A. Climate and Geography

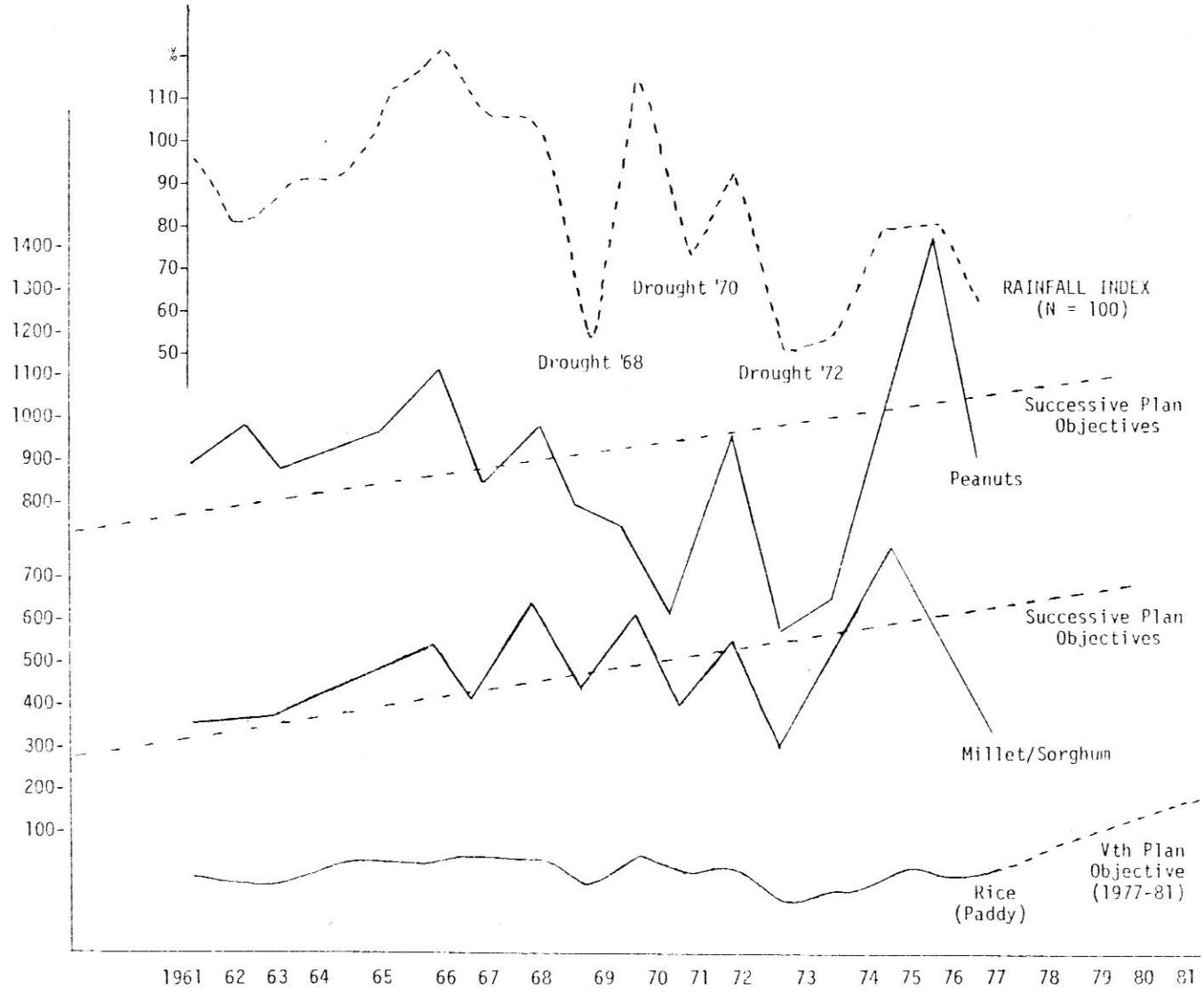
Senegalese agriculture is mainly rainfed, with only 10,000 to 15,000 hectares irrigated annually. At the same time, Senegal is a Sahalian country. As such it is subject to all the climatic uncertainties attached to this ecological zone. According to Stryker, the Sahelian countries as a group can expect a 15% shortfall in production every five years, a 20% deficit once in 10 years and a 30% decline once every twenty years (13). The CNRA of Bambey in Senegal (the National Agronomic Research Center) has shown that 50% of the annual fluctuations in agricultural production is determined by rainfall levels and, more importantly, by the distribution of rain over time.

In this respect the drought that has struck the Sahel countries almost continuously since 1968 is particularly serious. In 1972/73, for example, yields for millet and groundnuts in Thies Region dropped from a normal average of one ton per hectare to 70 kg for millet and 170 kg for groundnuts (6). The same situation prevailed in other regions: in the Casamance, rice production dropped by nearly 50% (2).

Figure 1 illustrates the catostrophic effects of the 1968, 1970 and 1972 drought periods on groundnuts, millet and rice production, with declines in production ranging from 30 to 50 percent. Individual regions were even more seriously affected.

Figure 1

Effects of the Drought on Production of Major Crops (1961-1976)



Source: V^e Plan de Developpement Economique et Social du Senegal (1977-81).

B. The Marketing System[3]

ONCAD (National Office of Cooperation and Assistance for Development) is the governmental agency responsible for marketing all agricultural outputs. In addition, ONCAD is responsible for the ordering and distribution of inputs: seeds, fertilizers and ox-drawn tools. It administers the short and medium-term credit supplied by BNDS (Senegalese National Bank of Development).

The marketing of groundnuts and cereals is achieved through the 2200 cooperatives (478 in Casamance) advised (we should say controlled) by ONCAD. The functions of the cooperatives are:

--to ascertain the collective input needs of the members;

--to inform ONCAD of these needs and input credit requirements;

--to distribute the inputs and collect the members' debts following the harvest;

--and to purchase groundnuts and cereals (millet, sorghum and rice) for ONCAD.

ONCAD has a legal monopoly for the buying and selling of groundnuts and cereals and for the distribution of agricultural inputs. Most inputs purchased by ONCAD are locally produced by a parastatal organization, SISCOMA, and private societies. These inputs, particularly fertilizers, have been heavily subsidized by the government to encourage production and adoption by farmers, but the increasing cost of this subsidy has led to a questioning of its desirability.

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[3]Most of the discussion in this section is taken from "Marketing, Price Policy and Storage of Food Grains in the Sahel," CRED, University of Michigan, 1977 (2).

ONCAD purchases groundnuts from the cooperatives and sells them to SONACOS, a parastatal organization which is responsible for processing groundnut oil for the export of oil and shelled peanuts. The millet and sorghum purchased by ONCAD from the cooperatives are sold to licensed traders: wholesalers, consumer and producer cooperatives, frontier stores, etc. With respect to rice, ONCAD purchases and sells both imported and local rice, often selling both in the same markets. Some rice development projects have been licensed by ONCAD to buy paddy directly from individual farmers for ONCAD's account.

For the collection and transportation of inputs and agricultural products, ONCAD owns a fleet of trucks in rather good condition. However, during the peak activity periods following the harvest, ONCAD generally supplements its own fleet by contracting private transport in order to overcome these seasonal bottlenecks.

ONCAD also has storage responsibilities for groundnuts, cereals (including domestic and imported rice) and inputs. Currently about 40,000 T of storage capacity for cereals and 240,000 tons of storage capacity for groundnuts are administered by ONCAD. Most of the storage facilities are located in the Peanut Basin[4], which accounts for 80 percent of the Senegalese groundnut production. As a result, peripheral regions such as Casamance, which are more cereal-oriented, encounter real difficulties in getting inputs and marketing their production.

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[4]The Peanut Basin is a large ecological zone including the major portion of the regions of Kaolack, Diourbel, Louga, and Thies.

Furthermore, ONCAD holds a legal monopoly for processing agricultural products, including milling paddy. In the Casamance, ONCAD operates both a rice milling plant and a groundnut shelling plant.

Producer prices are fixed by the government in collaboration with the "Comité des Grands Produits." This committee, formed by representatives of various ministries, is responsible for recommending to the Prime Minister a price structure for principal agricultural products. If the price structure is approved by the government, prices are immediately announced to the public, but the buying season is not opened until cooperatives repay ONCAD 80 percent of the seed debts received on credit by the cooperatives as a group. This causes delays in farmers getting cash for their output.

All these rigid institutional constraints have resulted in the emergence of an illegal parallel marketing circuit which seems to be very important for the marketing of cereals.

Figure 2 outlines the structure of both markets for rice, and gives some indication of transaction prices. The broken arrows indicate the illegal circuit and solid arrows the official circuits. Though the prices in Figure 2 relate to the Casamance, similar dual market structure is found throughout Senegal.

Judging by the small quantities of rice marketed by ONCAD (Table 5), we are inclined to think that the parallel market is more active than the official circuit in the Casamance. ONCAD's lack of success in rice marketing is due mainly to the following:

1) The cooperative chairman is paid a commission on the groundnut collection by ONCAD but not on the rice collection. During the buying period, the chairman and his assistants are, therefore, motivated to encourage farmers to sell groundnuts rather than paddy.

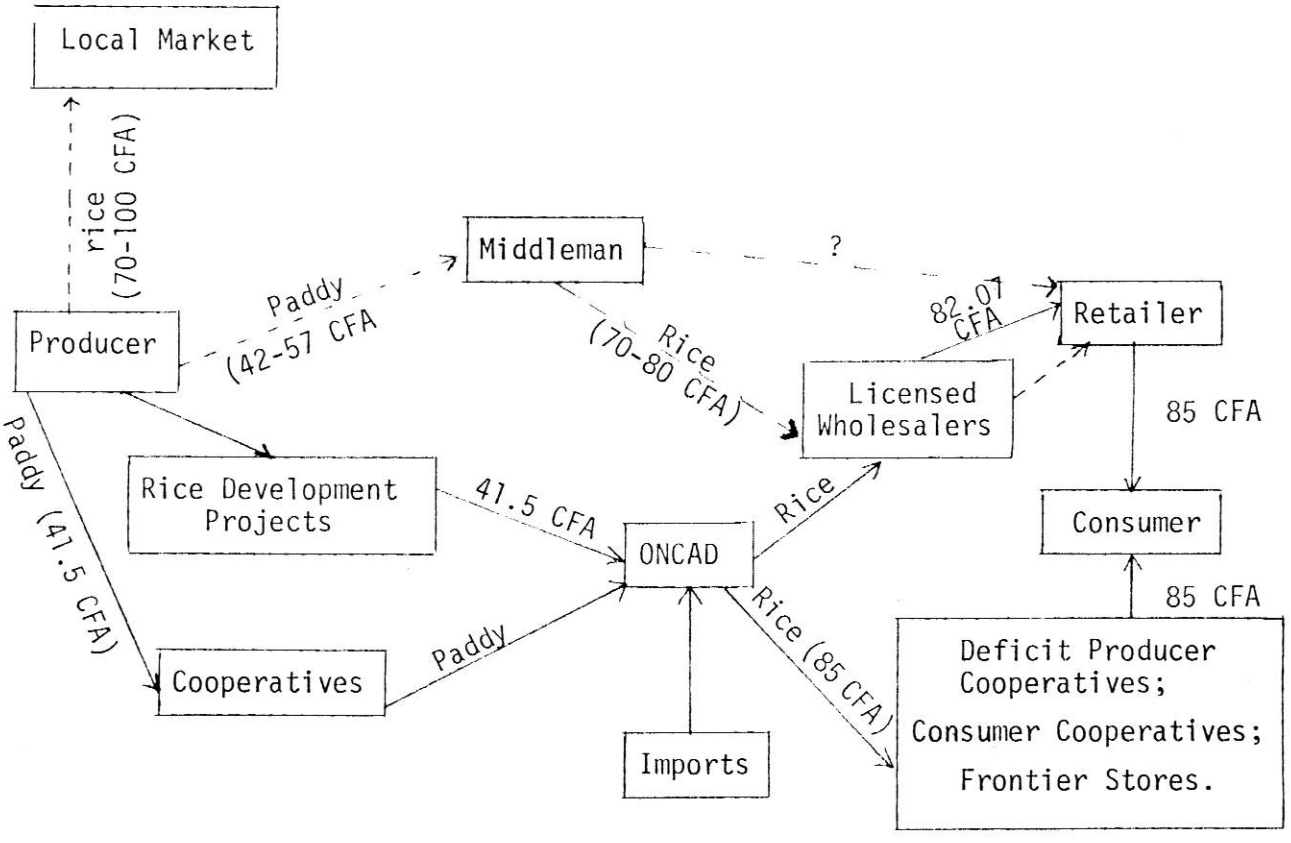
2) By tying the opening of the buying campaign to reimbursements of seed debts, ONCAD delays the beginning of its purchasing activities and creates a cash liquidity problem for many farmers. Furthermore, even if the buying season is opened early, ONCAD's payments to producers are often late (10).

3) On the parallel market, prices are generally much more attractive than those paid by ONCAD. Despite the fact that farmers are not permitted to sell milled rice, it is believed that most transactions on the parallel market involve processed rice. As we shall see later, processing is lucrative for both middlemen and farmers.

Constraints on the marketing system are not the only problems to be solved by ONCAD. The timing of input delivery is also a serious constraint on increasing agricultural output in general and rice production in particular. The supply of inputs to cooperatives is tied to the reimbursement of seed and medium-term debts (debts on ox-drawn tools). This is not usually completed until March and even May in the Casamance because farmers are very busy with the multiple tasks of harvesting and drying of paddy, harvesting and threshing of peanuts, gathering of straw for home-roofing, etc. During the same period, ONCAD gives highests priority to the collection and transport of groundnuts. This leads to late input deliveries so that farmers are often forced to delay the use of current year's inputs until next season. Moreover, because of lack of control and care in handling, large quantities of inputs get to the cooperatives in rather poor condition. All of these inefficiencies do not help improve ONCAD's image among farmers, who tend to regard it as an organization more inclined to cheat them rather than assist them.

FIGURE 2

Flow Diagram of Official and Parallel
Marketing Systems for Rice in the Casamance



Source: CRED (2) and SONED (12).

Table 5

Evolution of Paddy Production in Casamance and Quantities Marketed by ONCAD, 1964-1975

(Metric Tons)

YEAR	Casamance Production	Quantity Marketed through ONCAD	% of Total Production Marketed Through ONCAD
1964-65	81,000	228	0.28
1965-66	88,000	336	0.38
1966-67	82,000	231	0.28
1967-68	101,000	174	0.17
1968-69	43,000	38	0.08
1969-70	121,000	178	0.14
1970-71	68,486	441	0.64
1972-73	26,600	---	----
1973-74	49,100	---	----
1974-75	86,360	2464	2.85

Source: SONED (12)

A complete review of ONCAD's problems and difficulties would take us far beyond the scope of this paper. For the time being we will simply repeat "ONCAD has become a very large bureaucratic organization (ONCAD's budget is bigger than the state budget) whose major inefficiencies are due to the discrepancy existing between the multiplicity of its functions and its real capabilities (2)." A reorganization of ONCAD is needed at every level. This will call, in the first place, for greater decentralization.

C. Credit, Research and Extension

The credit system discriminates in favor of peanuts. The credit ceiling of cooperatives (through which loans are channeled to farmers) is calculated on the basis of the quantity of peanuts marketed. Thus in peripheral regions such as the Casamance where agriculture is more diversified and oriented toward cereals, farmers get a smaller volume of credit than farmers in regions where peanuts are the dominant crop.

The credit system also discriminates against women in that loans are granted only to the legal head of the family compound, the husband. In fact, women do have an active role in agricultural production, particularly in swamp rice cultivation.

In addition to these general weaknesses of the credit system which apply to all regions of Senegal, most cooperatives in the Casamance are small due to the fact that they were created primarily to achieve political rather than economic objectives. Aggregating smaller cooperatives into larger units would allow members in cooperatives not now producing large amounts of peanuts to increase their access to credit. This would be made possible by merging them with other small cooperatives producing large quantities of peanuts who are not able to utilize all the credit at their disposal.

Presently only about 20% of farmers use chemical fertilizers and oxen for rice cultivation. Thus, this enterprise has remained a traditional activity largely because it has been ignored by the agricultural extension and research services. Until the mid 1960's, most extension and research work was directed by the government toward the enhancement of groundnut production in the Peanut Basin. In such a context, research on food crops remained marginal. It is only after the severe drought of 1968 that research and extension organizations began to pay real attention to food crops. Today, drought resistent varieties of rice exist; but mechanization problems, for example, still remain to be solved in swamp rice cultivation.

Ox-drawn tools are not particularly adapted to swamp rice cultivation. Most animal drawn implements available in Senegal were designed for working conditions prevailing on the dry soils of the "Peanut Basin." Plows, for example, are designed for shallow cultivation rather than the deep plowing required for rice. Guide wheels on the plows and seeders become clogged with dirt and mud. The seeders themselves easily become clogged in the damp soils in which rice is usually planted. Once as much attention is given to the equipment needs of rice farmers, many such problems will, no doubt, be solved.

IV PRODUCTION INCENTIVES

A. Structure of Farms

The traditional farmer is more and more viewed as a rational economic agent whose decisions are based not only on subjective matters such as his preferences and tastes, but also on exogenous economic variables such as market prices.

Before looking into the interrelations between relative prices and the farmer's patterns of production, it will be helpful to present briefly the structure of an average farm in order to determine the food situation in the family compound. We will take as an example the case of a typical farm in Lower Casamance because this zone is where most rice production is concentrated and also because we lack reliable data on other areas of Casamance. Table 6 summarizes the size of the household labor force and the area under cultivation for an average household in various Departments of the Region.

The average farm in Lower Casamance produces 3.24 metric tons of cereals annually. Assuming that there are 5 adults and 6 children on the farm consuming an average of .2 tons of cereals per person per year and anticipating 10 percent for losses and reserves for seeds, it can be seen that in normal conditions, producing households should not have food problems , since after deduction of home consumption and losses there still is a remainder of .716 tons in addition to peanut production.

Table 6

Structure of an Average Farm
in the Lower Casamance

Department	No. of Adult Equivalent Persons Per Compound			CROPS GROWN									
				Groundnuts		Rice (Paddy)		Millet/Sorg.		Maize		Misc.	Total
	Males	Females	Total	A[a]	P[b]	A	P	A	P	A	P	A	A
Bignona	3	2	5	2.2	2.2	2.8	1.98	1.8	1.6	.25	.3	2	6.3
Ousouye	2	2	4	.4	.4	2.4	2.64	.3	.26	---	---	.25	3.9
Ziguinchor	2.5	2	4.5	.9	.9	1.5	1.65	.7	.6	.1	.12	.25	3.4
Lower Casamance	2.5	2	4.5	1.6	1.6	1.9	2.09	.8	.78	1.11	.37	.23	4.36

Source: Rigoulot, J.P. (9).

a) A = area cultivated in hectares.
b) P = total production in metric tons.

Excess paddy can be used for many purposes: 1) part of it may be stored to represent the family's wealth, 2) some may be used to feed hired workers if necessary, and 3) the rest may be either sold on the parallel market, bartered or used for ceremonies and festivals. Rarely is it sold to ONCAD. This situation suggests that the utility or marginal revenue product derived by farmers from these various uses is higher than that which they could derive from selling paddy to ONCAD.

B. Returns to Labor from Rice and Peanuts

Table 7 shows the evolution of official producer prices for groundnuts and rice from 1960 to 1978. On the basis of the ratio $\frac{PR}{PG}$ (price of rice over price of groundnuts) there is no long run average difference between the two prices. Therefore, for an indication of the disequilibrium between groundnut and rice prices, we might look at the evolution of the returns to labor from one hectare of each crop.[5] These are computed in Table 9 from data in Table 8 relating to traditional production technologies. At present most rice and peanuts in the Casamance are produced using these technologies. Table 9 indicates clearly the high returns per unit of labor for groundnuts relative to paddy at current prices. The returns to labor for groundnuts are more than 50% greater than for rice. Under 1979 input-output conditions, labor would be as valuable in rice cultivation as in ground groundnut production only if the price of rice were set at 63.2 FCFA;

[5] In the Casamance, farmers respond more to returns to labor than to returns to other factors for several reasons. First of all, farmers have little equity invested since cattle, equipment, and fertilizer are provided on credit by cooperatives and agricultural development projects. Principal and interest on this credit are paid at harvest time after the returns are in hand. Secondly, land is not traded, though farmers certainly attach considerable value to it. According to "La Loi Sur le Domaine National" land belongs to the Nation as a whole and only usufruct rights are recognized.

Table 7

Evolution of Official Producer Prices for Groundnuts and Rice (1960-1978) (FCFA)

	1960-64	65	66	67	68	69	70	71	72	73	74	75	76-78
Groundnuts	21	21	21	18	18	18	19	23	23	26	41.5	41.5	41.5
Rice	19	21	21	21	21	21	19	21	25	25	41.5	41.5	41.5
$\frac{P_R}{P_G}$	.90	1	1	1.17	1.17	1.17	1	.91	1.08	.96	1	1	1

Source: CRED (2).

Table 8

Input - Output Coefficients for Peanuts and Rice Using Traditional Production Technologies in the Casamance

	RICE					PEANUTS				
INPUT CATEGORIES	(1) QUANTITY	(2) UNIT-PRICE	(3) COST OF INPUT (1)X(2)	(4) SUB-SIDIES	(5) TOTAL COST OF INPUT (3)+(4)	(1) QUANTITY	(2) UNIT-PRICE	(3) COST OF INPUT	(4) SUB-SIDIES	(5) TOTAL COST OF INPUT (3)+(4)
a. Labor	188 M-D	250	47,000	--	47,000	100 M-D	250	25,000	--	25,000
b. Seeds	30 kg	52	1,560	--	1,560	100 kg	52	5,200		5,200
c. Fertilizers										
- NPK	--	--	--	--	--					
-UREA	--	--	--	--	--	--	--	--	--	--
d. Hand Tools	var.	--	300	--	300	var.	--	300	--	300
e. Total cost of production for one hectare	--	--	--	--	48,860	--	--	--	--	30,500
f. Yield (one hectare)	1,100 kg.	--	--	--	--	1000 kg	--	--	--	

Source: SOMIVAC (11).

Table 9

Returns Per Hectare for Labor,
and Production Cost for Peanuts and Rice Using
Traditional Production Technologies in the Casamance, 1979

COSTS/VALUES PER HECTARE	CROP	
	Rice	Peanuts
a. Value of Output per Hectare at Official Prices	45,650	41,500
b. Cost of Non-labor Inputs	1,860	5,500
c. Total Returns to Labor (a-b)	43,790	36,000
d. Return Per Unit of Labor	233	360
e. Cost of Labor at 250 FCFA/Day	47,000	25,000
f. Total Cost of Production (b+e)	48,860	30,500
g. Cost Per Unit of Output (f ÷ yield)	44.4	30.5

that is where the equality $\frac{36,000/100}{R_R/188} = 1$ holds for returns to labor where R_R is the total returns from labor for one hectare of rice yielding 1100 Kg of paddy and where non-labor costs of production amount to 1.69 FCFA per kilo for rice.

At this point, it appears that there is a large difference between what the producer price of rice ought to be, based on the returns per unit of labor (63.2 FCFA), and the official market price (41.5 FCFA). It is, therefore, legitimate to ask the questions: "Given such differences in prices and returns to labor, why does the farmer continue to produce rice? Why doesn't he just shift from rice to groundnuts?"

The answers lie in: 1) the value of rice as a wage good, 2) the higher total income the farmer can generate by distributing available labor between the two enterprises, as opposed to specializing in one, 3) the value he attaches to rice as distinct from the official market price, and 4) his desire to minimize the risk of crop failure by means of diversification.

C. Advantages of Producing Rice

1. Value of Rice as a Wage Good

The farmer's cash income is provided by the sale of his groundnuts, since he does not generally sell cereals to ONCAD. Their value to him as a reserve or for paying wages to hired labor considerably exceeds their value at official prices.

Table 10 indicates the amount of labor available to an average household. It suggests a shortage of labor in June and July amounting to 30 man-days based on average cropping patterns. In the Casamance this shortage is overcome with the help of neighbors who are usually paid with food, cigarettes and kola nuts as part of reciprocal labor exchange. The market

Table 10

Labor Profiles (estimates) for Major Crops Based on Traditional Cropping Patterns in the Casamance. (Man Days)

	Labor requirements (M-D) for one hectare of:		Labor Allocation (A)			(B)	Total HH Labor Available on farm (c)	Total Labor (M-D) used (A) + (B)
	Peanuts	Rice	Millet	Corn	Others (a)	Peanuts and Rice (b)		
January	--	20	--	--	var.	38	56	38+
February	--	--	--	--	var.	--	56	--
March	--	--	--	--	var.	--	56	--
April	--	--	--	--	var.	--	56	--
May	4	10	8	12	var.	25	56	45+
June (d)	30	23	17	18	var.	92	112	127+
July (d)	24	28	17	18	var.	92	112	127+
August	16	28	11	13	var.	79	112	103+
September	3	18	2	5	var.	39	56	46+
October	16	10	11	14	var.	45	112.	70+
November	2	16	1	--	var.	34	56	35
December	5	35	--	--	var.	75	112.	75
Total	100	188	67	80	var.	519	952.	666+

Source: Somivac (11) and author's own estimates.

Footnotes: (a) Other crops may include mainly vegetables (manioc, sweet potatoes, okra, etc...)
(b) Assuming an average area per farm of 1.6 Ha. of peanuts and 1.9 Ha. of rice.
(c) There are 4.5 actives on an average farm, each of them working a maximum of 25 days a month during peak periods (June, July, August, October and December) giving total labor available of 112 man days (4.5 X 25). In periods of slack activities (January to May, September and November) the total amount of labor available for agricultural enterprises is reduced, women in particular work less. We assume that the quantity of labor available or used in slack periods represents 50% of the amount of labor available in peak periods (50% of 112 M-D = 56 M-D).
(d) There is a labor shortage in June and July equal to (127 + 127) - (2 X 112) = 30 man-days. This labor is either hired or acquired via a labor exchange.

value of food and other items which a farmer usually gives to members of the community working on his fields amounts to only 1/4 to 1/3 of the daily cash wage (250 FCFA) for agricultural labor.

In effect farmers are able to get three times as much labor from their rice by feeding it to workers as opposed to selling it and hiring labor. It is true that a farmer must eventually repay this labor by working himself for the lower effective wage when he reciprocates. But he can do this at another time of the year when his own labor constraint has been overcome and other members of the group are experiencing theirs. This type of labor exchange in effect allows the farmer to transfer his own labor from slack periods to periods of high labor demand at no net cost.

2. Benefits of Mixed Cropping

We can estimate the benefits of mixed cropping by computing net income from rice and peanuts under current production patterns and comparing this to the net income which could be derived from the same resources if these were specialized in peanuts or rice. The average household produces 1.6 hectares of peanuts and 1.9 hectares of rice. His total net returns to labor used on rice and peanuts amounts to 140,801 FCFA, using the figures in Table 9, of which 57,600 FCFA would be net cash income, assuming he sells only peanuts for cash.

If we look at the returns from peanuts and rice in relation to the labor profiles detailed in Table 10, we can see that farmers would not increase their incomes by specializing in peanuts even at this low price for rice. The simplified linear programming analysis contained in Appendix A demonstrates this. From Table A-2 of this appendix, it is clear that the June labor constraint limits maximum peanut production to 3.07 hectares

However, June labor earns a higher return in rice than in peanuts--about 50% higher. Farmers, therefore, can increase both their net incomes and their returns per day of labor by using as much June labor as possible on rice since the constraint on rice - swamp land - has no value for peanuts. In fact, farmers exhaust the amount of rice land at their disposal before they exhaust available June labor. This leaves labor resources which can be productively employed in producing peanuts. Then resulting net income of 140,801 FCFA is compared to 110,520 if farmers were to specialize in peanuts. Thus, given 1) that no source of credit exits for hiring additional labor, 2) the high costs of labor saving techniques relative to the cost of labor, 3) the quantity of on-farm and off-farm labor available, and 4) the scarcity of swamp land for rice production, the farmer is maximizing his revenue with his current allocation of labor between peanuts and rice.

Another way of looking at this is to examine what would happen to cash income after food purchases if a farmer were to switch from rice to peanuts, since he would have to purchase his rice for household consumption at the official price of 85 FCFA for milled rice. The returns to his labor from the 3.07 hectares of peanuts which he could produce with his available labor would come to 110,520 FCFA, as we see in Appendix Table A-2. We then need to deduct from this cash income his expenditures for the purchase of milled rice in order to arrive at his net cash income, since he no longer produces paddy (paddy is not sold in the official retail circuit). To estimate expenditures for milled rice, we will hypothesize that the farmer and his family consumed all the paddy they formerly produced; that is, 2.09 metric tons. Converted into milled rice this amounts to 1,463 Kg, using an average milling rate of 70% (% of milled rice obtained from

paddy). At the retail price of 85 FCFA/Kg -- the price the farmer will have to pay if he buys his rice -- the farmer will have to spend 124,355 FCFA to replace his annual rice consumption. This would yield him a negative net cash income of 13,835 FCFA as opposed to the positive 57,600 FCFA in net cash income he earns when he produces both his own rice as well as peanuts, a total difference of 71,435 FCFA.

In effect, the farmer's paddy has a value to him for home consumption of 59.5 FCFA (85 x .70) rather than the 41.5 which ONCAD pays him. This increases his net income by 37,620 FCFA over what he would earn if he sold his production of peanuts and rice to ONCAD.

Beside the fact that specializing in peanuts reduces both cash and gross household income, there would be considerable risk associated with complete specialization. Indeed, it is now well established that traditional farmers diversify crop enterprises in order to reduce the risk of crop failure.

D. Summary

In summary, the comparison of the returns to labor from groundnuts and rice using official prices shows that present pricing policies do not provide sufficient incentives to motivate farmers to shift from groundnuts to rice. On the other hand, the programming analysis shows that total farm income is higher when rice is produced because of its higher returns to scarce June labor. Indeed, the only factor preventing farmers from devoting more June labor to rice production is the scarcity of suitable rice land. If rice land were not a constraint, farmers could produce 2.63 hectares of rice before confronting a December labor constraint. However, even if this option existed, farmers would not specialize in rice

production because of the higher returns to December labor allocated to peanuts. Only if producer prices for rice are increased will farmers be motivated to increase production of rice much above current levels. In the meantime, farmers will continue to produce rice for home consumption and groundnuts to meet their needs for cash.

Since farmers do sell some of their rice production on the parallel or illegal market, we must draw the conclusion that this market provides them with sufficient incentive to produce rice for sale. According to SONED, merchants procure paddy for a price of 4,000 FCFA/bag in villages. With an average bag weighing between 70 and 95 Kg, it follows that the kilo of paddy is priced between 42 FCFA and 57 FCFA in the parallel market (12). Thus, as compared to ONCAD, merchants pay higher prices for paddy which they either sell as paddy for 70-80 FCFA/Kg or process and sell as milled rice for 100 to 115 FCFA/Kg.[6]

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[6]The difference between the price of milled rice on the informal market (100-115 FCFA) and the price of milled rice on the official market (85 FCFA) can be considered a quality premium for local rice. Casamance rice is of good quality and can compete with the most expensive imports (1). Also, Senegalese are particularly choosy about rice quality. They prefer the "Siam" brokens which are not always available on the local market and they are willing to pay a premium to obtain the quality of rice they want.

V. IMPACT OF MARKETING & PROCESSING RESTRICTIONS ON THE FARMER'S INCOME

ONCAD has a legal monopoly on processing rice. Milling rice for sale by farmers, traders, middlemen, etc. is illegal. Still, according to Tuluy, there are between 30 to 40 small mills currently operating in Senegal, despite the risk of being caught (14). This would suggest that milling is a lucrative activity. We show this below.

A. Processing Costs

According to SONED,[7] 100 kg of paddy can be hulled by hand in about two days for an outturn of 70% with about 60% brokens. With labor priced at its reservation price of 250 FCFA per man-day, the cost of one kilo of handpounded rice is as follows:

Labor: 250 FCFA x 2 M-D = 500 FCFA

Since 100 kg of paddy yield 70 kg of rice, the processing cost of one kilo of handpounded rice is:

$$\frac{500}{70} = \underline{7.15 \text{ FCFA}}$$

Quantity of paddy necessary to produce one kilo of milled rice:

$$\frac{1 \text{ kg}}{.70} = 1.43 \text{ kg}$$

Paddy equivalent cost of hand-milled rice at the official price for paddy:

41.5 FCFA x 1.43 = 59.3 FCFA

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[7] Most data in this section are taken from SONED (12).

Paddy can also be hulled by small cooperative-owned hulling machines. Such mills are steel cylinder, 15-horse power machines. The average outturn from these units varies around 65% and their average capacity is about 350 kg of paddy/hour. We assume that cooperatives: 1) would be allowed to run these small units and 2) would acquire these on BNDS credit at the current rate of 6%. We compute the paddy equivalent price of milled rice from this technology as follows:

Acquisition price of a mill = 600,000 FCFA

Depreciation period: 5 years or 8 hours/day x 5 x 300 = 12,000 hours (assuming for sake of simplification that the mill will work only 300 days a year, the rest of the year (65 days) being used for maintenance and repairs.)

Yield in milled rice:

$$\frac{350 \times 65}{100} = 228 \text{ kg of milled rice/hour}$$

Gas Consumption: 2 litres/hour at 100 FCFA/litre = 200 FCFA/hour

Oil: Cost of oil is 8% of cost of gas = 16 FCFA/hour

Shelter: No cost. The shelter is built in the slack season with local materials so that no opportunity costs are involved.

Labor: 1 Serviceman at 192 FCFA/hour
2 Unskilled workmen at 100 FCFA/hour each = 200 FCFA/hour
1 Clerk (bookkeeping) at 192 FCFA/hour

Interest on loan - 6% per year over 5 years
108,000 FCFA/12,000 = 9 FCFA/hour

Insurance and repairs - 10% of acquisition price per year = 60,000 x 5; 300,000/12,000 = 25 FCFA/hour

Depreciation: 550,000/12,000 = 45.8 FCFA/hour assuming a salvage value of 50,000 FCFA

Using these figures, the processing cost of one kilo of milled rice is as follows:

$$\text{Processing cost of one kilo of milled rice} = \frac{200+16+192+200+192+9+25+45.8}{228} = 3.86 \text{ FCFA/kg}$$

Quantity of paddy necessary for an output of one kilo of milled rice:

$$\frac{1 \text{ kg}}{.65} = 1.54$$

Paddy equivalent cost of rice milled using small scale mills:

41.5 x 1.54 = 63.9 FCFA

B. Marketing Costs

The marketing costs are the cost incurred by the farmer when selling milled rice. They include:

1. Transportation Costs

If the farmer sells paddy to a cooperative or rice development project, he will incur no transportation cost since both the cooperative and project agents are based in the village. But, if the farmer wants to sell his milled rice on the local market, he may have to pay the cost of moving his product from the village to the market. He may do so either by cart, or bush-taxi or by bike. The latter being the most popular means of transportation of small loads (maximum = 50 kg) in rural areas of the Casamance, we will assume transport by bicycle. The cost of bicycle transportation is estimated as follows:

Acquisition price of a bike = 60,000 FCFA

Opportunity cost of invested capital = $\frac{60,000}{2} \times .15 = 4500$

where the opportunity costs of a farmer's capital is assumed to be 15% and 30,000 is the average value of the investment over its life.

Depreciation period = 6 years or 312 weeks

Repairs (2000 FCFA/year) = 2,000 x 6 = 12,000 FCFA

Quantity transported - 50 kg/load, three times a week = 150 kg or 46,800 kg (150 x 312) over the depreciation period.

Labor cost = the MVP of labor is assumed to equal zero during the dry season. Also marketing activities are linked to purchasing activities.

Transportation cost/kilo:

$$\frac{60{,}000 + 12{,}000 + 4500}{46{,}800} = 1.63 \text{ FCFA}$$

2. Storage Costs

Actually, storage cost can be assumed to be zero for the following reasons:

a) Usually the granary is not a separate room or building as such; it is just an area within the house (generally the space between the roof and the ceiling) where all cereal crops are stockpiled. Trying to estimate the storage cost for paddy only would lead us into joint cost allocation calculations more complicated than would be useful in the present case.

b) The storage period before sale is often so short relative to the life span of the house that even if we could allocate a storage cost, it would be negligible.

3. Handling Costs

There are no handling costs except for loading and unloading the bike, which are done by the farmer himself. These are negligible.

4. Market Fees

We assume that the farmer pays the market fees, although he usually manages to avoid those (often he uses the shop of a relative).

Total market fees = 30 FCFA/day
Market fees for one kilo = $\frac{30}{50} = .6$ FCFA

(assuming that the bike's load weighs a maximum of 50 kg).

C. Returns to Milling and Marketing of Rice by Farmers

Using the paddy equivalent of milled rice computed previously and the associated marketing costs, we can now estimate the additional returns to the farmer from milling and marketing as follows -

For handpounding we have:

Additional Returns to Handpounding and Marketing = (Official Price of Milled Rice) - (Paddy equivalent price of Handpounding Rice + Handpounding + Transport + Market Fees)

= 85 - (59.3 + 7.15 + 1.63 + .6) = 16.32 FCFA

For small scale milling we get:

Additional Returns to Small milling and Marketing = (Official Price of Milled Rice) - (Paddy Equivalent price of milled Rice + Milling Cost + Transport + Market Fees)

= 85 - (63.9 + 3.86 + 1.63 + .6) = 15.01 FCFA

In both cases the sale of processed rice is much more profitable to the farmer than the sale of paddy. On-farm paddy processing before sale is an illegal activity, but because of its high profitability and the employment it provides, many farmers do not hesitate to undertake it, despite the risk of being caught and fined. This might explain why milled rice transactions would be so important in volume on the parallel market. Indeed, as we point out later, the current marketing system's performance can be greatly improved. With a slight adjustment of the institutional framework (allowing farmers to sell milled rice) the welfare of producers could be increased without harming consumers or ONCAD.

VI. MIGRATION AND EDUCATION

According to the results of a general demographic census realized in 1970-71, about 51,000 persons left the Casamance during the dry season of 1971; that is, 8.2% of the total regional population. Most of this migratory outflow is seasonal but also has economic and social roots.

Males and females migrate in equal numbers. Migrants in general are young. Most go to large cities such as Dakar, Kaolack, Thies. They are led by both economic and social disparities between urban and rural areas. Economic disparities are reflected in the large income differences between urban and rural areas (5). Table 11 shows the magnitude of these disparities.

Table 11

Annual Personal Incomes for Peasants as Compared to Selected Categories of Urban Workers

Worker Category	Annual Income (FCFA)
Peasant - Farmer (Casamance)	30,000
Apprentice (urban sector)	54,000
Unskilled Workman (Modern Sector)	237,000
Maid (Dakar)	85,000

Source: SOMIVAC (11).

The lack of post-primary education facilities in the region also contributes to the out-migration from the Casamance. About 20% of migrants leave to continue their education in high schools, now mostly located in urban centers (11).

The inappropriateness of the educational system is obvious in other ways. Despite the fact that 70% of the Senegalese population live in rural areas, there are only two agriculture-oriented schools in the country. Furthermore, data published by the Ministry of Planning (Vth Plan of Development) indicate that although the number of students has more than doubled from 1960 to 1978 the unemployment rate has remained high (10-15%) and GNP has been increasing rather slowly at an average rate of 2.5% per annum. This suggests that educational programs do not fit the real needs of the country. Education is still too often regarded by planners and decision makers as an end when it should be considered a means, i.e., an "input" used in combination with other inputs such as land and capital.

The flexibility of the Diola social system also contributes to migratory outflows. But the impact of seasonal migration on rice production seems to be marginal since migrants usually come back home before the beginning of the planting season. The effects of permanent migration are far more disturbing. Indeed, in the long run it is legitimate to expect a decrease in production if labor-saving techniques are not included in farming patterns to offset the decrease in the supply of family-labor which results from these "one-way" migratory outflows. As a matter of fact, permanent migration not only reduces the quantity but also the quality of labor available to the farming sector by transferring the youngest and healthiest segments of rural population to urban areas.

VII. ALTERNATIVE SYSTEMS FOR PRODUCING, PROCESSING AND MARKETING RICE IN THE CASAMANCE

The lack of success of ONCAD in processing and marketing rice is reflected in the fact that without governmental subsidies, the intervention of ONCAD in these activities would result in a higher price of rice to the consumer than now prevails. In this section we look at alternatives to the present production, processing and marketing system which offer to improve market performance in both the short and long run.

To show this, we will consider two techniques for producing rice, traditional and improved, and three processing alternatives: handpounding and small scale milling at the farm (or cooperative) level and large scale (or industrial) milling by ONCAD at the regional level.

A. Systems for Producing Rice

1. Traditional Systems

The majority of farmers in the Casamance (about 70%) still use traditional methods of production. These are essentially based on the use of family labor. They almost entirely exclude the use of capital inputs such as chemical fertilizers, ox-drawn tools, improved seeds, etc. In other words, traditional farmers do not substitute capital for labor or land because their principal objective is not to maximize money income but to satisfy self-consumption first. They are in a "subsistence equilibrium."

With incomplete water control in swamps and low levels of organic fertilization (domestic wastes and residues from crops), yields are, in general, low and hardly exceed 1.1 T/ha.

2. Improved Techniques

Here also most agricultural operations rely heavily on use of human labor; but productivity is almost trebled by use of chemical fertilizers, high yielding varities and improved manual tools (e.g.: sickles instead of knives for harvest). Farmers in this category are more integrated into the market economy. They continue to view food self-sufficiency as a main objective but they also consider cash income an important source of wealth and well-being.

These farmers more readily accept the technical assistance provided to them by the government through extension organizations and, thus, achieve higher yields (2.5 t/ha), though they also have higher costs.

3. Comparative Costs for Producing Rice Using the Various Techniques

Table 8 summarizes the cost of producing rice using traditional techniques and Table 12 for improved techniques. Thus, we have from Table 8:

$$\text{Cost of producing one kilo of paddy in traditional system} = \frac{\text{Cost of Labor} + \text{Cost of Seeds} + \text{Cost of Tools}}{\text{Yield}}$$

$$= \frac{(47{,}000) + (1560) + (300)}{1100} = 44.4 \text{ FCFA/kilo}$$

and from Table 12:

$$\text{Cost of producing one kilo of paddy with improved techniques} = \frac{(\text{Cost of Labor}) + (\text{Cost of Seeds}) + (\text{Cost of Tools}) + (\text{Cost of Fertilizers}) + (\text{Cost of Extension Service})}{\text{Yield}}$$

$$= \frac{(44{,}500) + (1{,}560) + (1{,}500) + (6{,}400) + (9{,}500)}{2500}$$

$$= 25.38 \text{ FCFA/kilo}$$

Table 12

Input-Output Coefficients for Rice
Produced in Casamance Under
Improved Techniques of Production

Input Categories	(A) Quantity	(B) Unit-Price	(C) Cost of Input (A)x(B)	(D) Sub-sidies	Total Cost of Input (C)+(D)
Labor	178 M-D[a]	250	44,500	--	44,500
Seeds	30 kg.	52	1,560	--	1,560
Fertilizers					
NPK	100 kg.[b]	25	2,500	1,600	4,100
Urea	50 kg.[b]	35	1,750	550	2,300
Hand Tools	Variable	--	1,500	--	1,500
Extension Service	--	--	--	9,500[a]	9,500
Total Cost of Production for One Hectare	--	--	--	--	63,460
Yields	2,500 kg.	--	--	--	--

Source: SOMIVAC (11) and author's own estimates.

a) Estimate.

b) Extension Service recommendations.

Thus, relative minor changes in production techniques can lower the cost of producing rice from 44.4 to 25.4 FCFA per kilo, a 43% reduction.

B. Processing and Marketing Systems

In previous sections, we have discussed two processing techniques, handpounding and small scale milling. When the quantity of paddy to be processed is large enough, larger milling units such as the one operated in the Casamance are often used.

In Table 13, we compare the processing and marketing costs of milled rice produced from these three processing techniques with similar costs for imported milled rice. Combining these data with the figures obtained from Table 12, we get the following costs per kilo of milled rice for the various production-processing-marketing combinations.

1. Traditional Production and Handpounding

Cost of one kilo	=	Production cost of paddy equivalent	+	Handpounding cost	+	Transport	+	Market Fee
72.9 FCFA	=	(1.43 x 44.4)	+	7.15	+	1.63	+	0.6

2. Traditional Production and Small Scale Milling

Cost of one kilo of milled rice	=	Production cost of paddy equivalent	+	Milling Cost	+	Transport	+	Market Fee
74.5 FCFA	=	(1.54 x 44.4)	+	3.86	+	1.63	+	.6

Table 13

Processing and Marketing Costs for One Kilo of Milled Rice from Various Sources

	Hand Pounding	Small Scale Milling	Large Scale[a] Milling	Imports
(A) Paddy equivalent to 1 kilo of milled rice	1.43kg	1.54kg	1.67kg[b]	
(B) Processing Costs				
1) Hand pounding	7.15 FCFA	---	---	
2) Small mill	---	3.86 FCFA	---	
3) Large Mill	---	---	6.25 FCFA	
(C) Storage/bags	---	---	0.25 FCFA	0.25 FCFA
(D) Transport	1.63 FCFA	1.63 FCFA	7.784 FCFA	7.65 FCFA
(E) Handling			1.648 FCFA	1.0
(F) Others	0.6[c]	0.6[c]	0.382 FCFA[d]	

Source: SONED (12) and author's own estimates.

(a) all the figures in this column are drawn from SONED

(b) using a paddy equivalent rate of 60%, $\frac{1kg}{.6}$ = 1.67 kg

(c) market fee

(d) difference between various costs (salaries, repairs, etc...) and revenue from sale of by-products.

3. Improved Production and Handpounding

Cost of one kilo of milled rice	=	Production cost of paddy equivalent	+	Handpounding Cost	+	Transport	+	Cost of Container[8]	+	Market Fee

46.7 FCFA = (1.43 x 25.38) + 7.15 + 1.63 + 1.0 + 0.6

4. Improved Production and Small Scale Milling

Cost of one kilo of milled rice	=	Production cost of paddy equivalent	+	Milling Cost	+	Storage Cost	+	Transport Cost	+	Market Fee

46.2 FCFA = (1.54 x 25.38) + 3.86 + 1.0 + 1.63 + 0.6

5. Large Scale Milling (ONCAD)

Cost of one kilo of milled rice	=	Paddy equivalent price of one kilo of milled rice	+	Milling Cost	+	Storage Cost	+	Transport Cost	+	Handling	+	Others

85.6 FCFA = (1.67 x 41.5) + 6.25 + 0.25 + 7.784 + 1.648 + 0.382

The paddy equivalent rate used for large scale milling by ONCAD is 60%; it is low because of the old age of ONCAD's milling plant in the Casamance. The price (41.5) used in computing the paddy equivalent price of milled rice is the price paid by ONCAD to producers.

6. Imported Milled Rice

The cost of one kilo of imported milled rice at Ziguinchor, the principal city in the Casamance Region, is:

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[8]Cost of container: in the case of traditional swamp rice we assume that storage is done in homemade bags (local material) so that no storage cost is incurred (or is negligible). But in the case of improved swamp rice cultivation, production is large enough to justify the use of manufactured bags. One bag costs 300 FCFA and can contain 100 kg of milled rice; assuming that one bag can be used three times; the "lodging" cost of one kilo of milled rice is: 300 FCFA/300 kg = 1.0 FCFA.

Price of one kilo of imported milled rice	=	Price c.i.f. Dakar	+	Storage Cost	+	Transport Cost	+	Cost of Handling and others

78.9 FCFA = 70.0 + 0.25 + 7.65 + 1.0[9]

where the c.i.f. price is a simple average of 1974-77 c.i.f. prices.[10]

C. Implications for Cost of Production and Pricing Policy

These comparisons yield the following conclusions:

1) Slight improvements in production techniques, i.e., use of fertilizers and sickles instead of knives for the harvest, permit a reduction in the costs of production of swamp rice through a combination of an increase in yields (2500 kgs/ha versus 1100) and a reduction of labor requirements (178 M-D/Ha instead of 188 M-D/Ha).

2) The lowest total costs of milling rice is obtained with the alternative associating improved techniques with small scale milling. The highest total cost is obtained when ONCAD is directly involved in processing. ONCAD's high processing costs are due to the fact that this agency is operating an aging plant in the Casamance at a low capacity. Even using the lower costs associated with improved production of rice (25.38) and assuming a more efficient conversion of paddy to rice than is possible in the current decaying plant (1.55), the cost of rice milled by ONCAD would still be 55.7 FCFA as compared to 46 FCFA for the small scale alternative and 49 for the handpounding alternative.

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[9] 1.0 FCFA represents the cost of handling and contingencies.

[10] Average c.i.f. prices were obtained by dividing value of rice imports by the quantity imported as reported in FAO Trade Yearbook (1977). These figures are reported in Table 15.

3) ONCAD's monopoly for milling creates a non-Pareto optimum situation. A Pareto better situation could be reached if ONCAD quit processing and if farmers and private traders were allowed to mill and sell milled rice at the current official price (85 FCFA/kg). In such a situation, the additional returns (15.01 FCFA/kg) which farmers would earn from processing could more than compensate people currently employed by ONCAD.[11]

4) It is clear, contrary to the conclusions of many studies[12], that rice produced in Casamance can be competitive with imported rice for consumption in the Casamance and nearby areas. In fact, rice from Casamance delivered to Dakar could compete on a cost basis with imported rice if the Casamance rice is processed in small scale milling units and improved production techniques are employed. The comparative costs of the two sources of rice can be estimated by dropping the transportation margin from imported rice to the Casamance and adding 175%[13] of it to rice produced and processed in the Casamance to cover assembly and transportation costs. On this basis, Casamance rice would cost 59.6 FCFA delivered to Dakar wholesalers versus 71.3 FCFA for imported rice.

If we then take into account the fact that Senegalese consumers prefer the quality of rice produced in the Casamance and are willing to pay a

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[11] People currently employed in processing by ONCAD are transporters and other workers at the assembly and handling stages. Their total cost, 9.814 FCFA/kg (7.784 + 1.648 + 0.382), is much lower than additional returns (15.01 FCFA/kg) from private milling.

[12] See in particular: Stryker (13); Kathryn Craven and A.H. Tuluy (1) and Tuluy (14).

[13] Assuming local assembly costs are 75% of long distance transport costs; that is: 7.65 x 1.75 = 13.4FCFA (12).

substantial premium[14] to get it, we can say, beyond doubt, that the rice produced using improved techniques and processed in small scale mills in the Casamance has a competitive advantage over imported rice for all of Senegal since all imported rice passes through Dakar.

5) It is also clear that the current ONCAD price of 41.5 FCFA is not adequate to cover the cost of producing rice under traditional production technologies. When paddy is valued at its acquistion value to the rural household --59.4 FCFA/kg -- the returns per man-day of labor employed in producing and processing rice is 299 FCFA (Appendix B). If we used a price of 250 FCFA per man day, the generally agreed average daily wage in the Casamance for agricultural labor to value labor used in rice, the cost of producing paddy in this way would be 44.4 FCFA per kilo versus the official price of 41.5 FCFA. Thus, up to the point where a household is producing rice for its own consumption, only a producer price above 59.5 would increase marketed supplies. Once household demand is met, additional supplies would be forthcoming only at a price in excess of 44.5 FCFA. We would, thus, expect little supply response for any increase in the price of paddy up to 45 FCFA, and an increasingly elastic supply response as producer prices rise above that level. At a producer price of 60 FCFA or above, ONCAD would probably get the most of the paddy produced in excess of household needs.

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[14] Currently, locally produced and milled rice sells for 90-100 FCFA as compared to 85 FCFA for imported rice form ONCAD.

VII. COMPARATIVE ADVANTAGE OF PRODUCING RICE VS PEANUTS

To show whether Senegal has a comparative advantage in producing peanuts versus rice or not, we will compare the foreign exchange earning power of these two crops.

A. Foreign Exchange Earning Power of Rice Produced in Casamance

In section C of Chapter VII, we have shown that Casamance rice produced with improved techniques and processed in small scale mills would cost 59.6 FCFA delivered to Dakar wholesalers versus 71.3 FCFA for imported rice, thus yielding a saving in foreign exchange of:

Saving in foreign Exchange earned by one kilo of Casamance rice	=	Dakar c.i.f. price of one kilo of imported rice	-	Dakar Wholesale price of one kilo of Casamance rice

11.7 FCFA = 71.3 FCFA - 59.6 FCFA

This means that the domestic resource cost[15] of a franc of foreign exchange savings is .84 francs when rice is produced with the domestic resources.

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[15] Normally when we speak of the domestic resource cost of a unit of foreign exchange, we refer to economic costs in which shadow prices have been used for all inputs and outputs. Our analysis has done this only partially by including input subsidies in costs of production and using border prices for output. However, we could not shadow price transportation and marketing costs since sufficiently detailed data is not available.

B. Foreign Exchange Earning Power of Peanuts Produced in Casamance

From Table 14, we have the cost of producing one kilo of unshelled peanuts in Casamance, using improved techniques of production similar to the level assumed for rice. Peanuts are shipped unshelled from the Casamance to Dakar, then shelled in Dakar and exported. We then can calculate the foreign exchange earned by exporting one kilo of shelled peanuts from Dakar as follows:

1. Quantity of unshelled peanuts necessary for one kilo of shelled peanuts:

one kilo of shelled peanuts = $\frac{1}{.70}$ = 1.43 kilos of unshelled peanuts

using a recovery factor of 70%

2. Price of one kilo of shelled peanuts at Dakar:

Price of one kg of shelled peanuts at Dakar = (Cost of (unshelled (peanuts (+ Transport/assembly cost of unshelled peanuts) X[16] Conversion factor + Processing[17]

62 FCFA = (30 FCFA + 13.4) x 1.43 + 0

Now to get the amount of foreign exchange earned from producing peanuts, we get the following:

Foreign exchange earned from exporting one kilo of Casamance shelled peanuts = Dakar f.o.b. value of one kilo of shelled peanuts - Cost of one kilo of shelled peanuts at Dakar

66 FCFA = 128 - 62

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[16] Assuming that transport/assembly costs are the same for both rice and peanuts. See footnote 12.

[17] Peanut shells are used to generate electricity. We assume that the economic cost of shelling is equal to the economic value of fuel provided by the shells since we have no data on processing costs.

Table 14

Cost of Producing One Kilo of Peanuts
in the Casamance, Using Improved Techniques

Improved System (one hectare)					
Input Categories	(A) Quantity	(B) Unit-Price	(C) Cost of Input (A) X (B)	(D) Subsidies	Total Cost of Input (C) + (D)
Labor	74	250	18,500		18,500
Seeds	100	52	5,200		5,200
Fertilizers					
NPK	100	25	2,500	1,600	4,100
Hand Tools	Var.	--	300		300
Oxen Traction	1 unit[a]	4,390[b]			4,390
Extension Service	--	--	--	9,500[c]	9,500
Total Cost of Production for one hectare					41,990
Yields (kg/ha)	1,400	--	--	--	--
Cost of One Kilo of Peanuts		$\frac{41,990}{1400} = \underline{\underline{30}}$ FCFA			

Source: Labonne and Legagneux (6)

Footnotes to Table 14 are on next page.

Footnotes to Table 14:

a) One traction unit includes: ... a pair of oxen
... a Super ECO seeder
... a UCF plow
... a Sine hoe
... and the accessories.

b) This figure is computed from the following costs including interest on loan and subsidy: ... pair of oxen = 50,000 FCFA
... Super ECO seeder = 27,381 FCFA
... UCF plow = 22,218 FCFA
... Sine hoe = 17,520 FCFA
... Accessories = 8,000 FCFA
... The oxen pair has a salvage value of 90,000 FCFA after five years (the pair is bought when it is three years old and sold five years later).

We assume:

1) Animal fodder is provided by residues of crops whose marginal value product is equal to zero (no alternative use).

2) No labor cost for maintenance of oxen. This is done by the farmer himself.

3) Farmer has little equity invested since cattle and equipment are given on credit and repayment of both principal and interest takes place at harvest time.

4) A depreciation period of 5 years.

5) The traction unit is totally allocated to the cash crop (peanuts).

$$\text{Cost of traction per hectare} = \frac{\left[\begin{array}{l}(\text{Cost of Oxen}) + (\text{Cost of Seeder}) + (\text{Cost of Plow}) + (\text{Cost of hoe}) + (\text{Cost of Accessories})\end{array}\right] - (\text{Salvage})}{(\text{Area Planted to Peanuts}) \times (\text{Depreciation Period})}$$

$$\underline{4{,}389.8\ \text{FCFA}} = \frac{\left[(50{,}000) + (27{,}381) + (22{,}218) + (17{,}520) - (8{,}000)\right] - (90{,}000)}{(1.6) \times (5)}$$

c) Estimate.

where the f.o.b. value is a simple average of 1974-77 f.o.b. prices for shelled peanuts (Table 16). This yields a domestic resource cost of earning one franc of foreign exchange of .48 francs when peanuts are produced with domestic resources.

C. Comparative Advantage of Rice Versus Peanuts

Comparing the domestic resource cost of foreign exchange saved by producing rice in Casamance with the domestic resource cost of foreign exchange earned by producing peanuts for export clearly yields, at first glance, the conclusion that "Senegal's comparative advantage in terms of economic efficiency still lies in groundnuts" (Stryker, 1978). Though this may be true, Stryker's analysis is incomplete for two reasons:

1) This analysis does not account for the cost of the destructive agronomic impact of specializing in peanuts. Indeed, as early as 1960, Gillier (4) mentioned the disruptive impact on the soils of the Peanut Basin, due to continuous groundnut cultivation.[18] Today, soil fertility in certain groundnut producing areas of Senegal is so low that fields would need to be put into fallow for decades to improve soil structure and reduce soil acidity so they can regain their productivity (6). Alternatively, soils might be regenerated through sophisticated and expensive soil management techniques; but these costs would substantially reduce the net benefit to Senegal of producing peanuts over the longer run. Furthermore,

[18] In order to harvest groundnuts the entire stalk and root systems are removed from the ground. After harvesting these are fed to the draft animals used for cultivating peanuts. Thus, little crop residue remains to maintain the organic matter content of the soils.

some authors suggest that the recurrent drought in Senegal may be caused by the "slash and burn" technique commonly used in the production of groundnuts (8).

2) The analysis also excludes the political and strategic costs to Senegal of being so dependent on food imports and international food aid. For the time being, Senegal can afford to import rice and pay for it with the foreign exchange earned by the peanut exports. But how long will this situation last? What would happen if rice exporting countries decided to raise their prices or if they were no longer in a position to export? More important, what will be the long run impact of rising energy prices on the prices of commodities transported long distances?

Basically, any economic analysis comparing the costs of producing rice versus peanuts in Senegal should deal with these important problems. This is not our purpose here but these points do need to be raised.

Table 15

Average c.i.f. Price (Dakar) of
One Kilo of Imported Milled Rice

	1974	1975	1976	1977
Quantity Imported (metric tons)	207,181	102,119	200,000	218,005
Value (1000 $)	75,015	28,253	55,500	60,000
Conversion Factor	1000 FCFA= $4.81	1000 FCFA= $4.67	1000 FCFA= $4.191	1000 FCFA= $4.07
c.i.f. Price of One Kilo (FCFA)	87.037	59.243	66.213	67.620
Average (FCFA)	$\frac{87.037 + 59.243 + 66.213 + 67.620}{4} = 70.03$			

Source: FAO Trade Yearbook, Vol. 31, 1977

Table 16

Average f.o.b. Price (Dakar) of
One Kilo of Shelled Goundnuts

	1974	1975	1976	1977
Quantity Exported (metric tons)	9,917	9,484	122,410	25,800
Value (1000 $)	5,843	6,184	53,700	13,300
Conversion Factor	1000 FCTA= $4.16	1000 FCFA= $4.67	1000 FCFA= $4.191	1000 FCFA= $4.07
f.o.b. Price of One Kilo of shelled goundnuts (FCFA)	141.63	139.62	104.67	126.66
Average (FCFA)	$\frac{141.63 + 139.62 + 104.67 + 126.66}{4} = 128.145$			

Source: FAO Yearbook, Vol. 31, 1977

IX. CONCLUSION AND POLICY RECOMMENDATIONS

The Senegalese government has repeatedly and clearly defined its intentions to encourage domestic production of rice so as to reduce current imports. This is feasible since rice produced in the Casamance can compete with more expensive imports on a cost basis. However, the rapid achievement of such an objective is unlikely as long as the discrepancies and inconsistencies outlined in this paper prevail.

The food situation in general and rice production, in particular, could be significantly improved if the following actions were taken:

A. In Marketing

1. Reduce the price advantage of groundnuts over paddy by setting the price of paddy at a level above the cost of producing it with traditional farming techniques.
2. Reorganizing the food marketing system to give ONCAD a different role. Under the new system, ONCAD's roles should focus on:
   a. importing milled rice and marketing inputs;
   b. buying paddy only if the market price falls below a minimum floor price based on cost of production. This will require ONCAD to keep track of fluctuations in market prices and even to be able to predict them. This will, therefore, call for the creation of an information network which will be responsible for collecting and analysizing relevant market information.

3. Encourage private and cooperative paddy milling. Some kind of contract might be arranged between private traders and ONCAD whereby the farmer would be permitted to use the latter's processing facilities.

This stream of measures would bring about a Pareto - better improvement since all parties would gain. ONCAD would be freed from the burden of marketing paddy, an activity in which it is not really interested anyway; producers would be guaranteed a more equitable floor-price; consumers would be assured a ceiling price; and private traders would acquire the freedom to enter the market.

B. In Credit

As said earlier, ONCAD's responsibility as a lending institution should be maintained provided the adjustments below are undertaken:

1. Merge small non-viable cooperatives into larger units.
2. Modify present cooperative rules so as to provide credit to any farmer (man or woman) who pays the membership subscription. Current rules are biased in favor of peanut producers and male farmers.
3. Base the maximum volume of credit available to a cooperative on the amount of money collected from farmers' subscriptions, not on the quantity of peanuts marketed.
4. Diversify the array of inputs offered on credit to include tools specifically adapted to rice production (ox-drawn tools currently available are more suited to peanut production).

C. In Education

The role of cooperatives should not be limited, as is presently the case, to marketing agricultural products but should be widened to include other activities such as adult education, e.g., teaching young farmers improved techniques of production, basic skills in writing and arithmetic, etc.

If young farmers were provided an adequate level of education through village cooperatives, they would be able to increase their incomes from farming and thus, would be less tempted to migrate.

D. In Production

Senegal's apparent comparative advantage lies in peanuts; but fostering the expansion of this crop beyond current levels of production would have long-run political and agronomic implications which need to be weighed by policy makers. Furthermore, complete specialization in peanuts is not possible because swamp lands are not suitable for peanut production.

A valid agronomic alternative open to Senegal is to encourage the development of food crops in general as a means of preserving its land resources already deeply depleted by a quasi-peanut monoculture.

E. In Research

More work is needed on mechanization and swamp rice production technologies. Too many questions are still unanswered, e.g: should farmers use ox-drawn tools provided these are improved to fit the working conditions prevailing in swamplands? Or should they use mechanical tillers? What are the economics of these two alternatives? These and similar questions need to be addressed.

APPENDICES

APPENDIX A

APPENDIX A

Simplified Programming Analysis

Assumptions

1. The area which can be planted to peanuts is assumed to be large relative to the area which can be planted to rice. Only water logged lands for swamp rice are scare in the Casamance. It is reasonable to assume that the average farmer will not be able to increase average area in rice over the 1.9 hectares currently planted nor can he, with the land at his disposal, cultivate more than 10 ha in peanuts.

2. From Table 10, we also know that for June and July combined, on-farm labor supply is 30 man-days short of needs. This additional labor is acquired from an off-farm source. However, since peanuts and rice constitute crucial enterprises, we assume that the farmer will allocate total on-farm labor available so as to meet the requirement of these two crops first. This assumption implies that the quantity of labor available to peanuts and rice in peak periods will equal the maximum amount used on both crops in any one month at present, or 92 man-days. expect this to be particularly true for the months of June, July, August, and December, during which on-farm labor is in shortage.

For other months we assume only 1/2 of household labor is available to rice and peanuts because of labor required for household chores and other activities. At this level of constraint the labor supply in these months does not constrain output.

Table A-1.

Resource Situation and
Requirements for Enterprises

Resource	Amount Available	1 ha of Peanuts	1 ha of Rice
Land (ha)			
Dry land	10	1	--
Swampland	1.9	-	1
Labor (man-days)[a]			
January-May	280	4	30
June	92	30	23
July	92	24	28
August	92	16	28
Sept.-November	168	21	44
December	92	5	35
Net Income at Official Prices		36,000	43,790

a) Assuming available labor does not exceed maximum amount now used on peanuts and rice in any one month, and available labor during slack periods equals 1/2 of the amount of labor available for all agricultural enterprises during peak periods (see Table 10 in the text).

Table A-2

Maximum Amount of Each Enterprise per Constraint

Resource	Amount Available	Peanuts	Rice
Dry Land (ha)	10	10	--
Swampland (ha)	1.9	--	1.9
Labor (man-days)			
January-May	280	70.00	9.33
June	92	3.07	4.00
July	92	3.83	3.29
August	92	5.75	3.29
Sept.-Nov.	168	8.00	3.82
December	92	18.40	2.63
Maximum Net Income at Official Prices		110,520	83,201

Table A-3

Returns per Unit of Resource

	Peanuts	Rice
Dry Land (ha)	36,000	-
Swamp Land (ha)	-	43,790
Labor (man-days)		
January-May	9,000	1,460
June	1,200	1,904
July	1,500	1,564
August	2,250	1,564
Sept.-Nov.	1,714	995
December	7,200	1,251

APPENDIX B

Table A-4

Farm Plan

Activity	Dry Land	Swamp	J-M	June	July	Aug	S-N	Dec	Revenue
Unused	10.0	1.9	280	92	92	92	168	92	
1.9 Rice	-	1.9	57.0	43.7	53.2	53.2	83.6	66.5	83,201
Unused		0	223.0	48.3	38.8	38.8	84.4	25.5	
1.6 Peanuts	1.6	0	6.4	48.0	38.4	25.6	33.6	8.0	57,600
Unused	8.4	0	216.6	0.3	0.4	13.2	50.8	17.5	
									140,801

APPENDIX B

Table B-1

Returns to Labor for Rice in the Casamance Using Traditional Production and Processing Technologies With Paddy Valued at its Acquisition Price to the Household

		FCFA
Value of output per hectare at acquisition price (59.44 FCFA)		65,384
Cost of non labor input		
-Seed (30 kg x 1.25.59.44)[a]	2,229	
-Hand Tools	300	
	2,529	
Returns to Labor		62,855

a) Seeds are reimbursed in kind with an interest of 25%

Table B-2

Labor Inputs for Producing and Handpounding Rice

	Men-Days Required Per Hectare
Field Labor (Table 10)	188
Handpounding (1 M/D per 50 kg. of paddy for a total of 1100 kg/ha)	22
Total Labor Inputs	210

Table B-3

Average Returns per Day of Labor for Rice and Peanuts Using Acquisition Value for Rice and Sale Price for Peanuts

Crop	Area	Total Labor Input (M/D)	Total Returns To Labor	Returns per M/D of Labor
Rice	1.9	399	119,424	299
Peanuts	1.6	160	57,600	360
Totals	3.6	559	177,024	317

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