

139
C.2

Latin American Demand Study:

Status Report

CIAT
BIBLIOTECA
10 JUL 1997
62750

The economic study of cassava in Latin America has had to telescope into two years a process which probably should have required at least two years more. The study of cassava in Latin America has been compounded by the relatively large number of countries, the dearth of reliable secondary data, and the very complex policy environment in which cassava must be analyzed. The following document thus represents a work still in progress. Nevertheless, the document does present in some detail a synopsis of the findings for individual countries that have emerged from the study.

The eventual final report will have two principal sections. The first section will develop the principal issues effecting cassava in the different markets. In this section Latin America is treated as a whole or in a comparative framework and the focus is on cassava within individual markets. The second section has a country focus and the potential of cassava in each individual country is analyzed, with particular attention given to the policy environment in each country.

In the following document only the country studies are presented. These include Brazil, Colombia, Venezuela, Paraguay, Panama and Mexico. The studies for Peru, Ecuador, Dominican Republic and Jamaica are still being written, although the data collection and analyses are essentially complete. Haiti had to be dropped from the study due to the coup d'etat midway through the study. A visit was made to Nicaragua and an attempt was made to collect relevant data; nevertheless, Nicaragua will have only a partial analysis due to lack of reliable data. Finally, during the two years various attempts have been made to develop a collaborative project with Cuba, in which the cassava sector would be evaluated. Although the relevant ministries have been very positive, approval has yet to be granted.

None of the projected first section is included in this document. A table of contents of that section is attached to the end of the report. To date only chapters 3 and 8 have been written. This outline must be seen as an end objective for eventual publication. A reduced version of this first section will be developed for presentation to the TAC as an introduction to the country studies.

In terms of market coverage starch has remained elusive. Very little data exists on this market in Latin America and yet any primary data collection would be very expensive in order to cover the various end uses for the product. Some

data on Brazil has been collected but little more on this market has been either uncovered or collected.

Table of Contents

- I Economic Study of Cassava in Brazil
- II Colombia: Potential Demand for Cassava
- III Paraguay: Potential Demand for Cassava
- IV Cassava Potential in Mexico and its Relationship with the Rest of the Economy
- V Cassava Potential in Panama and its Relationship with the Rest of the Economy
- VI Venezuela: Potential Demand for Cassava
- Appendix I: Outline of "The Cassava Economy of Latin America: A Food Staple in Transition"

ECONOMIC STUDY OF CASSAVA IN BRAZIL

(FIRST REPORT)

EMPRESA BRASILEIRA DE PESQUISA AGROPECUARIA (EMBRAPA)

AND

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL (CIAT)

AUTHORS:

Carlos A. Ibañez-Meier (CIAT)

Willem Janssen (CIAT)

Vander Gontijo (EMBRAPA)

James Cock (CIAT)

January, 1987.

CONTENTS

	Page
CHAPTER 1: INTRODUCTION	3
CHAPTER II: AGRICULTURAL POLICY IN BRAZIL	7
CHAPTER III: HUMAN CASSAVA CONSUMPTION	12
CHAPTER IV: THE MARKET FOR ANIMAL FEED RATIONS	18
CHAPTER V: THE SUPPLY OF CASSAVA	25
CHAPTER VI: PRIVATE AND SOCIAL PROFITABILITY OF CASSAVA PRODUCTION IN BRAZIL	32
CHAPTER VII: CONCLUSIONS: THE NEED FOR CASSAVA DEVELOPMENT IN BRAZIL	47
APPENDIX 1	
APPENDIX 2	
APPENDIX 3	

DEMAND STUDIES IN BRAZIL

CHAPTER I

INTRODUCTION

Brazil is the world's largest cassava producer with a total production comprising 16% of world production and close to 80% of Latin American production. Historically cassava has played a fundamental role in Brazil as a source of carbohydrates for human consumption and as a source of employment and income in the poorer rural areas especially in the North East. It has certain inherent characteristics that have made it an important crop grown in all areas of Brazil: it has very high productivity per unit land area; it is well adapted to adverse climatic and soil conditions; it has no fixed planting date or time of harvest; it can be harvested when needed over a long period of time and it rarely fails as a crop.

In the last 15 years however the pace of increase in cassava production has not kept up with the rapid urbanization and industrialization. Cassava production and utilization patterns have not changed to meet the new requirements of an urban, industrial society. This trend has been aggravated by government policies that have favored export crops such as soya and grain crops at the expense of traditional staples such as cassava and beans. These trends are disturbing as they have had potential negative effects on the nutritional level of the poorer segments of the population and the income level of the small farmers who produce these staples.

In order to understand how cassava will fit into the agro-economy of Brazil in the coming years it is necessary to analyze the production processing and marketing of cassava.

The diversity of climatic, edaphic and social conditions in Brazil is great, ranging from the tropical rain forest of the underdeveloped Northern region, through the very poor semi-arid areas of the North East to the sub-tropical and relatively advanced Southern states. These differences indicate that no single study can adequately cover this variability, and hence the studies presented in this document are on a regional basis.

OBJECTIVES

The objective of these studies is to determine how cassava can fit into the Brazilian agricultural economy in the future in such a manner that it assists the country in reaching policy goals such as improved welfare of the rural community and increased availability of low priced food to the population as a whole.

The specific objectives of the study are:

- 1) Analyze the current and potential role of cassava for human consumption with special attention to the country's nutritional policies.
- 2) Evaluate the income generation and employment opportunities created by cassava production and processing.
- 3) Describe the current and potential incorporation of cassava into animal feed.
- 4) Identify the regions where cassava production can be expanded and the markets which it will enter.

INFORMATION SOURCES

This study is based on two principal sources of information. Firstly the demand side analysis is based on the IBGE Survey of household expenditure and consumption. In order to avoid bias caused by grouping of the data in the published reports this analysis is based on the raw data obtained from the IBGE tapes. Secondly the supply side analysis is founded on the EMBRAPA, EMBRATER and CIAT farm survey carried out on 1200 farms. These farms were carefully selected using modern statistical sampling techniques to ensure an adequate coverage of the wide range of conditions encountered in Brazil. In this manner it is felt that interpolation can be made to areas not covered in the survey. The survey data were collected in Rio Grande do Sul, Santa Catarina, Parana, Minas Gerais, Bahia, Pernambuco, Maranhao and the Federal Territory of Parana.

DOCUMENT LAYOUT

This first chapter serves as the introduction to the studies, the second chapter briefly summarizes the recent developments in the Brazilian agricultural sector with special emphasis on agricultural policies and on the balance between food production and exports.

The third chapter analyses trends in cassava for human food and its future potential role. The fourth chapter turns to an analysis of the rapidly expanding animal feed industry and the fifth chapter looks at the supply side concentrating on production and processing aspects.

The sixth chapter concentrates on the cost structure of cassava production and processing and sets this in the framework of cassava's future role as a source of rural income and its contribution to food and feed supply.

Finally in chapter seven the conclusions and recommendations are presented.

SPECIAL TERMINOLOGY

In this document the use of the word farinha is reserved for the special toasted cassava meal or flour used throughout Brazil. The word aipim is used for cassava that is eaten in the fresh form. This cassava is sweet, with a low HCN level as opposed to the roots used for the production of farinha or starch.

CHAPTER II

AGRICULTURAL POLICY IN BRAZIL

1950-1963

In the decade of the fifties and the early years of the sixties economic development policies were directed to stimulating the growth of the industrial sector and the substitution of manufactured imports. In order to achieve this policy goal, policies favored the industrial sector at the expense of the agricultural sector.

The Cruzeiro was overvalued, food prices were controlled at low levels and agricultural exports were restricted. These policies were coupled with the freezing of urban salaries, strict control of the price of basic agricultural products and restrictions on the importation of agricultural inputs. These policies, which were designed to increase the rate of growth of the industrial sector, restricted the growth of the agricultural sector due to a negative effect on demand (eg. through low salaries in the urban sector) and also to problems on the supply side (eg. lack of availability of inputs).

These negative effects were to a certain extent mitigated by subsidies to fertilizers and other inputs for grain crops and traditional export crops such as coffee. Furthermore, the large areas of unexploited frontier lands and low cost rural labor allowed the agricultural sector to subsist and even expand during this period.

1964-1972

In this period policies began to change in a manner that favored the agricultural sector. The Cruzeiro was subject to a series of small devaluations; quality control on exports of agricultural goods were relaxed and other tariff barriers were reduced. In addition the price controls on food products were reduced and subsidized credit was made available to the agricultural sector. This credit beared negative real interest rates and compensated for the high price of agricultural inputs and the high price of rural labor that resulted from the rapid rural to urban migration in this period. Cheap credit and high labor costs resulted in rapid mechanization and increases in the use of inputs. This change occurred in those crops that respond to mechanization and heavy use of inputs, principally crops that were grown by the farmers in the richer southern states. Thus crops such as soya were favored over the traditional crops such as tree cotton, cowpea and cassava grown in the poorer states of the North East.

On the demand side a series of factors began to stimulate the agricultural sector. World prices for agricultural prices were high thus making export an attractive option. It was at this time that the exportation of soya bean began to grow rapidly. Internally the growth of the industrial sector created increased purchasing power in the urban sector with its positive impact on the demand for agricultural products.

In addition the government indicated that the future development of Brazil lay in the vast unexploited central western region and established the city of Brasilia in this area. This region developed rapidly whilst the North East in spite of its high population and low level of development was largely neglected and did not share in the development taking place in the rest of Brazil.

1973-1979

The oil crisis in the early years of the seventies renewed the fears of excessive dependence on the state of the world economy. To this was added rapid inflation. These two factors induced the government to adopt measures that tended to decrease imports and increase the exports from the industrial sector. Once again this provoked a new recession in the agricultural sector. In order to compensate the policies for subsidized credit were maintained and there was a rapid increase in the research and extension efforts in the agricultural sector. Minimum prices were established for certain agricultural products and the wheat subsidy program was initiated. All these measures tended to favor the richer southern states and the larger farmers.

The overall economic development of Brazil was rapid in this period due to the rapid increase in manufactured exports, and easy access to international credit.

1980-1984

Repeated cuts in the supply of petroleum products by OPEC and the resulting increases in oil prices coupled with fears about protectionism in the developed countries reinforced Brazilian consciousness of their vulnerability to external factors that effect their development process. This was further increased by the enormous external debt and high interest rates. The government turned to the agricultural sector to assist in alleviating the critical economic situation in which the country found itself. The production of alcohol to replace imported oil was a component of this policy.

In addition for the first time the government began to turn to the objective of stimulating the production of food crops

(other than wheat which was subsidized heavily in the decade of the seventies) rather than seeing the agricultural sector mainly as a means of reducing the balance of payments deficits through export crops.

1985-1986

In 1985 the civilian government was installed in Brazil. This has brought with it an increased awareness of social goals in the formation of policies. Of particular concern are the low nutritional level of millions of people, the low level of development in the North East, the skewed distribution of land holdings, and the ravages of the rampant inflation that has plagued Brazil in the last decade. The agricultural sector is seen as critical in reaching more equitable development in Brazil in the coming years.

As a result the government has set the target of improving the nutritional situation through increased production of food crops; rice, beans, cassava and maize have been set as priority crops. Credit will be expanded in such a manner that the small and intermediate size producer, who has traditionally been the major food producer, has access to it. As a further stimulus to the producer the minimum price policy has been reactivated. Furthermore, the government is committed to a land reform program that will be supported by integrated rural development projects. Whilst in the past emphasis has been on the export crops in the South present policies are geared to developing the agricultural frontier and the so often neglected North East. This program will not only concentrate on the production side but will also assist in the development of infrastructure, education marketing and other aspects necessary for the development of the region. A special program has been established for this area with support from the ministry of irrigation to facilitate

the rapid implementation of irrigation projects in the area. These are expected to be of the order of 19 billion US\$ over the next 15 years.

At present these policies are to a certain extent negated by the rigid price controls that form part of the temporary plan -Cruzado that has drastically reduced inflation. Nevertheless the present policies favor the food crops such as cassava that are produced by the smaller farmers in a manner that is unique in the recent history of Brazil.

CHAPTER III

CASSAVA FOR HUMAN CONSUMPTION

A series of studies on nutrition in Brazil indicate that a large proportion of the population suffers from malnutrition. The World Bank(1979) study indicated that 58% of the population less than 17 years old suffers from malnutrition. In terms of people this translates into 19 million young people with first grade malnutrition; 10.5 millions with second grade and 0.5 million with third grade (Table 3.1). This malnutrition affects a large part of the population, results in physical defects and mental retardation, and in severe cases in high levels of infant mortality.

The malnutrition is related to low levels of hygiene in the poorer areas, and a series of health related problems. The major cause is simply the lack of sufficient calories in the diet of large sectors of the population. The IFPRI (1982) study indicated that the caloric intake was below minimum requirements in almost all regions of the country, with the greatest deficit in the North and North East (Table 3.2). Furthermore the the situation was worse in the urban than the rural areas.

Cassava is a major calorie source in Brazil. The data of the IBGE survey (ENDEF) shows that rice and sugar were the two most important caloric sources in 1975, followed by cassava, beans and wheat which are all about equally important. There are however regional differences; in the North cassava at 27% of the total calorie intake and in the North East at 23% is the most important calorie source. The consumption is highest in the rural areas but still reaches levels of 290

calories per capita per day in the urban centers of the North East and 465 calories per day in the North (Table 3.3). The tendency for higher consumption in the rural areas runs throughout Brazil.

Cassava is consumed in two principal forms in Brazil: firstly as farinha (a toasted flour) and secondly as aipim or fresh cassava. Farinha consumption at 17.6 kg/cap/year as the national average is much more important than aipim at 6.1 kg/cap/year. The importance of farinha is also greater in the North and North East regions at about 45 kg/cap/year than in South and South East at 3.5-6 kg/cap/year.

CONSUMPTION TRENDS

The per capita consumption of cassava declined in the period 1960 to 1975 from 93 kg/yr to 59 kg/yr (Table 3.4). The decline was most pronounced in the South where the urbanization process has been most rapid in the last 20 years. The decrease in per capita consumption is related to two fundamental causes: the massive rural to urban shift altered consumption patterns and the wheat subsidy reduced the price advantage of farinha over wheat flour.

Urbanization has been extremely rapid in Brazil. The population census of 1960 and 1984 show the urban population rising from 48.6% to 72.4%. There has been a shift to the consumption of more convenient food sources. At the same time new marketing channels have been developed and a more varied diet is available.

The production of wheat in the Southern states is an attractive option for farmers who grow soya in the summer and wheat in the winter months. Both crops use similar machinery and do not compete for land or labor as they are planted in different seasons. Perhaps the factor that makes

wheat so attractive is the high price. The government, concerned with the balance of payments, and wishing to reduce inflation and maintain low cost food in the urban centers adopted the measure of subsidizing local wheat production. Wheat production is not easy in Southern Brazil, yields are low and fluctuate widely from year to year. This results in enormous sums of money being required to sustain the policy goal of low consumer prices whilst at the same time inducing farmers to produce the crop. The World Bank estimates that the wheat subsidy is greater than 1 billion US\$ in 1986 (recently the Economist quoted 1.5 billion US\$ as the estimate for 1986). The form of the subsidy is such that the World Bank estimated that the consumers did not receive any effective subsidy in 1970 but by 1981 they received 90% of the subsidy (Table 3.5).

The wheat subsidy has obviously distorted the price structure for starchy staples and has affected the competitive ability of cassava. The cross elasticities for wheat and cassava are positive; this indicates that wheat substitutes for cassava. In the period 1972 to 1980 the relative price of cassava flour to wheat flour increased (Table 3.6). As a result there has been substitution and the consumption of cassava flour (farinha) has declined. In the case of aipim (fresh cassava) the high yield levels in the South have enabled fresh cassava to maintain its price relative to wheat even when this was falling due to subsidies. As a result consumption of aipim has increased in the South. In the North East however the relative price of both aipim and farinha has increased and this has obviously led to substitution of wheat for cassava.

In 1980 the government concerned with the high cost of the wheat subsidy began to slowly reduce the level. As a result there has been a slight tendency for the price of cassava relative to wheat to decrease (Table 3.6). At present the

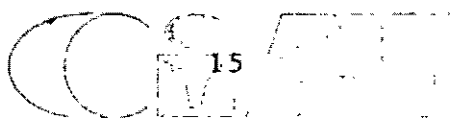
government is in the position of being committed to reducing the wheat subsidy, however at the same time it wishes to reduce inflation. Wheat plays an important part in the determination of the consumer price index and although reducing the subsidy is obviously an economic necessity, it may well be politically difficult.

URBAN CONSUMPTION TRENDS

The consumption of farinha on a per capita basis has declined in the last 15 years. This is partially due to the urban to rural migration, since urban consumption per capita is three times as low as rural consumption. Nevertheless, analysis of urban farinha demand shows some interesting features. The demand for farinha calculated at constant prices has apparently increased in the urban areas. This is of great importance as the urban centers are those that face the greatest nutritional problems. How has this increase in demand occurred?

In the lower income groups the demand for cassava increases as incomes rise (i.e. it is a normal good). This is very plausible as the lower income groups do not have sufficient resources to meet their basic nutritional requirements. As their income increases they will purchase basic foods such as farinha. The overall income elasticity is indeed negative, richer people wish quite naturally to have a more varied diet. The natural tendency is to interpret this fact as indicative that there will be a decrease in demand as incomes rise. This neither takes into account the differences in income elasticity in different income groups nor the overall increase in the population and the segments of the population in which this occurs.

In the last 15 years in Brazil the lowest income groups are those that are increasing most rapidly. The percentage of



the population with incomes less than the minimum salary increased from 17% to 33% (Table 3.7). At the same time the urban population increased dramatically (Table 3.8). The average income levels also tended to increase (Table 3.9). The population increase, the income increase and distribution, and the farinha demand parameters were combined in a model to predict the demand for farinha at constant prices. In Table 3.10 it can be seen that there was a substantial overall increase in the demand for farinha. The increase in demand takes place in the poorest segments of the population that have the greatest nutritional problems. This increase in demand more than compensated for the decrease in demand in the richer segment of the population. Thus in the North East demand increased from 114 thousand tons for the population with less than one minimum salary income level to 426 thousand tons. In the highest income groups demand declined from only 58 thousand tons to 39 thousand tons. This indicates that if farinha prices can be maintained or reduced a substantial increase in total demand can be expected in the coming years.

FRESH CASSAVA

The low levels of cassava consumption in the urban areas are apparently related to the inconvenient nature of this highly perishable product. This problem is illustrated by the fact that whereas over 90% of the farinha consumed in the urban areas enters through commercial markets only 55% of fresh cassava for human consumption follows this path (Table 3.12). Furthermore the marketing margins account for 80 to 90% of the final consumer price in the major urban centers in the South (Table 3.11) due to the high risks involved in marketing cassava. The price elasticity and the income elasticity of cassava are both high. All the above stated facts indicate a buoyant demand for fresh cassava if the

problems of perishability can be obviated. New fresh cassava conservation technology developed by CIAT has the potential to greatly reduce the perishability of cassava and also its price to the urban consumer thus opening up the market for fresh cassava.

TABLE 3.1
NUMBER AND PERCENTAGE OF CHILDREN UNDER 17 YEARS OLD
WITH FIRST, SECOND AND THIRD DEGREE OF MALNUTRITION BY REGION
(1975)

REGION	DEGREE OF MALNUTRITION					
	FIRST		SECOND		THIRD	
	No.	%	No.	%	No.	%
	(1000)					
NORTH	2234	39.0	1131	23.3	42	0.7
NORTHEAST	6332	38.2	4630	28.0	361	2.2
SOUTHEAST	10783	36.2	4581	15.4	44	0.2
BRAZIL	19349	37.2	10543	20.2	447	0.9

SOURCE: CHERYL WILLIAMSON GRAY. "FOOD CONSUMPTION PARAMETERS FOR BRAZIL AND THEIR APPLICATION TO FOOD POLICY".
International Food Policy Research Institute.
Research Report No. 32. September 1982.

TABLE 3.2
AVERAGE PER CAPITA DAILY CALORIE DEFICITS
BY REGION AND URBAN/RURAL LOCATION (1975)

REGION	AVERAGE CONSUMPTION	ESTIMATED REQUIREMENTS *	CALORIE DEFICIT
(CALORIES)			
NORTHEAST			
URBAN	1814	2150	336
RURAL	2016	2145	129
NORTH			
URBAN	1750	2232	482
RURAL *	1926	2226	300
SOUTH/ SOUTHEAST			
URBAN	2127	2299	172
RURAL	2445	2273	

(*)SOURCE: CHERYL WILLIAMSON GRAY. "FOOD CONSUMPTION PARAMETERS FOR BRAZIL AND THEIR APPLICATION TO FOOD POLICY".
International Food Policy Research Institute.
Research Report No. 32. September 1982.

TABLE 3.3

AVERAGE PER CAPITA DAILY CALORIE CONSUMPTION FOR EACH FOOD BY REGION AND URBAN OR RURAL LOCATION, 1975.

FOOD TYPE	SOUTH AND SOUTHEAST			NORTHEAST			NORTH	CENTER WEST	BRAZIL		
	URBAN	RURAL	TOTAL	URBAN	RURAL	TOTAL	URBAN	URBAN	URBAN	RURAL	TOTAL
CEREALS	814.82	991.42	878.98	574.33	476.14	518.82	479.82	852.63	659.83	753.91	698.55
Rice	465.32	525.22	487.08	217.67	258.79	240.92	178.75	609.88	355.51	402.41	374.82
Maize	36.47	181.90	89.31	51.24	149.95	107.05	5.96	25.76	34.03	167.17	88.83
Wheat Bread	195.53	50.31	142.77	252.03	54.36	140.27	249.31	150.96	185.13	52.18	130.41
Macaroni	68.12	56.42	63.87	36.37	7.45	20.02	33.52	40.87	50.91	33.85	43.89
Wheat Flour	31.26	166.96	80.56	5.20	1.61	3.17	4.90	12.98	20.22	90.75	49.24
ROOTS AND TUBERS	66.90	160.85	101.04	332.95	616.17	493.07	478.73	84.31	131.81	370.72	230.13
Potatoes	27.00	26.45	26.80	4.63	0.43	2.26	5.06	12.05	17.57	14.46	16.29
Fresh Cassava	7.40	38.49	18.69	8.91	15.85	12.83	3.73	20.51	7.40	28.06	15.90
Cassava Flour	25.24	77.98	44.40	293.45	572.16	451.02	465.93	40.90	96.23	305.76	182.46
SUGAR	306.18	349.98	322.09	229.64	196.7	211.02	168.77	238.72	246.62	279.33	260.08
LEGUMES	178.74	281.90	216.22	214.29	404.9	322.05	101.11	181.17	163.70	338.59	235.68
Beans	171.27	266.89	206.01	190.78	346.2	278.65	94.49	175.04	153.66	303.45	215.30
VEGETABLES	27.52	21.89	25.47	12.55	8.48	10.25	8.69	20.75	20.15	15.71	18.32
FRUITS	47.17	28.12	40.25	46.83	26.4	35.28	41.00	45.33	41.41	27.32	35.61
MEAT AND FISH	193.87	159.89	181.52	200.30	162.69	179.04	262.30	173.18	174.30	161.18	168.90
Beef	87.44	36.17	68.81	103.68	52.8	74.91	129.75	101.03	83.03	43.84	66.90
Pork	33.94	61.24	43.86	34.16	53.8	45.26	17.10	31.87	29.46	57.81	41.13
Poultry	27.11	23.97	25.97	17.85	9.32	13.03	14.73	16.64	21.06	17.22	19.48
DAIRY PRODUCTS	145.31	132.21	140.55	82.94	72.18	76.86	68.70	110.67	110.83	104.54	108.24
OIL AND FATS	322.84	302.42	315.42	105.72	45.9	71.90	121.44	328.14	232.00	184.18	212.32
BEVERAGES	24.59	17.12	21.88	14.44	7.27	10.39	19.90	14.96	18.93	12.58	16.32
TOTAL	2127.93	2445.79	2243.42	1814.01	2016.83	1928.68	1750.46	2049.86	1799.58	2248.07	1984.15

SOURCE: ENDEF 1975, 1986.

TABLE 3.4
PER CAPITA CASSAVA CONSUMPTION IN 1960 AND 1975

REGION	1 9 6 0			1 9 7 5		
	FRESH	FLOUR	TOTAL	FRESH	FLOUR	TOTAL
(In Kilograms)						
NORTHEAST	7.1	55.2	172.6	4.3	43.7	135.4
URBAN	.9	26.8	81.3	3.2	20.4	64.4
RURAL	10.3	69.7	219.4	5.2	55.0	170.2
SOUTHEAST	11.8	17.0	62.8	4.5	5.9	22.2
URBAN	4.4	6.4	23.6	2.0	2.7	10.1
RURAL	20.2	29.0	107.2	5.0	14.1	47.3
SOUTH	44.6	12.1	86.9	15.8	3.5	26.3
URBAN	3.7	5.2	19.3	7.6	2.5	15.1
RURAL	68.7	16.2	117.3	23.2	4.4	36.4
BRAZIL	14.9	26.3	93.5	6.1	17.6	58.9
URBAN	3.0	11.4	37.8	2.7	9.7	31.8
RURAL	24.7	38.3	139.5	11.2	29.4	99.4

SOURCE: FUNDACAO GETULIO VARGAS, 1979; AND, IBGE, 1978.

TABLE 3.5
WHEAT SUBSIDIES RECEIVED BY PRODUCERS AND CONSUMERS
(MILLION OF 1977 US\$)

	TOTAL SUBSIDY (A)	CONSUMER SUBSIDY (B)	B/A (%)	PRODUCER SUBSIDY (C)	C/A (%)
1968	36.6	16.43	44.9	20.12	55.1
1969	60.1	28.87	48.1	31.30	51.9
1970	33.3	-30.74*	0.0	64.05	100.0
1971	32.1	-60.11	0.0	92.23	100.0
1972	113.0	108.42	95.9	4.49	4.1
1973	222.8	248.71	100.0	-25.93**	0.0
1974	299.2	391.19	100.0	-92.05	0.0
1975	517.3	495.74	95.8	21.49	4.2
1976	424.6	377.20	88.8	47.36	11.2
1977	292.9	158.85	54.2	134.04	45.8
1978	707.1	705.53	99.7	1.56	.3
1979	828.4	760.52	91.8	67.74	8.2

(*): Means that both Government and Consumers subsidised Producers.

(**): Means that both Government and Producers subsidised Consumers.

SOURCE: WORLD BANK, "A REVIEW OF AGRICULTURAL POLICIES IN BRAZIL", September 1981.

TABLE 3.6
CASSAVA RELATIVE PRICES
(Price of Cassava/Price of Flour Wheat)

PORTO ALEGRE		SAO PAULO		RIO		SALVADOR		FORTALEZA	
FLOUR	ROOT	FLOUR	ROOT	FLOUR	ROOT	FLOUR	ROOT	FLOUR	ROOT
(5-years moving average)									
69/73	0.56	0.68		0.57	0.44	0.86	0.58	0.52	0.31
70/74	0.61	0.72		0.61	0.44	0.86	0.58	0.58	0.31
71/75	0.74	0.88	1.14	0.69	0.47	1.04	0.55	0.61	0.32
72/76	1.04	0.96	1.24	1.42	0.99	0.64	1.36	0.55	0.72
73/77	1.22	0.85	1.44	1.37	1.25	0.77	1.49	0.68	0.87
74/78	1.38	0.86	1.60	1.36	1.17	0.75	1.62	0.79	0.97
75/79	1.60	0.97	1.78	1.43	1.12	0.80	1.95	1.11	1.15
76/80	2.10	1.12	2.09	1.64	1.03	0.65	2.25	1.42	1.54
77/81	2.02	1.10	1.93	1.58	0.66	0.44	1.80	1.37	1.68
78/82	1.86	1.07	1.78	1.50	0.45	0.24	1.70	1.15	1.64
79/83	1.76	1.05	1.66	1.46	0.57	0.34	1.53	1.07	1.61
80/84	1.72	0.91	1.61	1.29	0.82	0.35	1.39	0.85	1.61

SOURCE: ANUARIO ESTATISTICO, IBGE.

TABLE 3.7
DISTRIBUTION OF PEOPLE BY SALARY CLASS (1976/1984)

	SALARY GROUPS (MINIMUM=1)				Without Response	TOTAL
	SC=<1	1<SC=<2	2<SC=<5	SC>5		
	(Percent)					
1976	16.93%	25.07%	31.84%	25.13%	1.03%	100.00%
1981	29.80%	25.60%	23.20%	11.00%	10.40%	100.00%
1985	33.00%	22.60%	22.30%	12.10%	10.00%	100.00%

SOURCE: "ANUARIO ESTATISTICO DO BRASIL", FIBGE

TABLE 3.8
ACTUAL AND ESTIMATED POPULATION 1970/1990

POPULATION	NORTHEAST		SOUTHEAST		SOUTH	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
1970	11723	16359	28965	10889	7303	9193
1976	14837	17985	36947	9540	9575	10462
1980	17586	17275	42848	8904	11881	7156
1983	20244	16988	47419	8609	12671	7275
1986 *	22430	16745	53602	7011	14534	6398
1990 *	26405	16591	62367	3732	17253	4852

SOURCE: "ANUARIO ESTATISTICO DO BRASIL", FIBGE

(*): ESTIMATED

TABLE 3.9
MINIMUM SALARY BY REGION (1975/1985)

	GPI *	NE	SE	S
(REAL, BASE YEAR=1977)				
1975	49.63%	841.43	996.17	1073.54
1976	70.10%	859.34	1016.83	1095.58
1977	100.00%	868.80	1027.20	1106.40
1978	138.74%	1295.66	1518.81	1634.71
1979	213.53%	1609.52	1964.41	1943.33
1980	427.47%	1667.49	1980.21	1980.21
1981	897.30%	1604.81	1850.89	1850.89
1982	1753.74%	1744.84	1982.96	1982.96
1983	4463.80%	2176.98	2176.98	2176.98
1984	14311.70%	2327.61	2327.61	2327.61
1985	41160.74%	1457.70	1457.70	1457.70

SOURCE: "ANUARIO ESTATISTICO DO BRASIL", FIBGE
(*): GENERAL PRICE INDEX

TABLE 3.10
URBAN CASSAVA FLOUR DEMAND (thousand TN/year) BY INCOME GROUP

	NORTHEAST	SOUTHEAST	SOUTH
(URBAN AREAS)			
SALARY GROUP			
1975/1976			
1 Min Salary	114.28	48.18	10.83
2 Min Salary	119.92	27.70	6.09
5 Min Salary	139.00	23.31	6.02
8 Min Salary	58.54	14.00	2.70
1980/1981			
1 Min Salary	296.85	93.16	24.27
2 Min Salary	159.65	30.96	7.89
5 Min Salary	109.03	18.50	5.55
8 Min Salary	24.60	6.66	1.49
1985/1986			
1 Min Salary	426.07	149.72	37.51
2 Min Salary	187.63	39.74	9.74
5 Min Salary	146.20	25.93	7.47
8 Min Salary	38.95	10.69	2.30

TABLE 3.11
FRESH CASSAVA PRICES AT FARM AND RETAIL LEVEL
IN SAO PAULO AND RIO DE JANEIRO

	SAO PAULO			RIO DE JANEIRO		
	RETAIL	FARM	F/R	RETAIL	FARM	F/R
1970				160.3	17.7	11%
1971	193	15.5	8%	195.4	27.7	14%
1972	204	22.2	11%	184.0	25.7	14%
1973	267	21.4	8%	197.8	24.3	12%
1974	317	20.2	6%	223.2	35.8	16%
1975	283	31.2	11%	244.8	55.2	23%
1976	301	59.3	20%	219.9	79.2	36%
1977	240	37.9	16%	206.5	75.5	37%
1978	217	16.6	8%	200.4	26.5	13%
1979	221	14.2	6%	200.8	33.6	17%
AVERAGE			10%			19%

SOURCES: FUNDACAO GETULIO VARGAS AND IBGE.

TABLE 3.12
PERCENT OF CASSAVA CONSUMPTION THAT IS PURCHASED BY
URBAN AND RURAL LOCATION
(1975)

REGION	% OF CASSAVA PURCHASED	
	FRESH CASSAVA	CASSAVA FLOUR
CENTER WEST		
URBAN	39.22	74.18
NORTH		
URBAN	44.09	82.17
NORTHEAST		
URBAN	44.14	86.67
RURAL	6.50	49.59
SOUTHEAST		
URBAN	55.81	91.74
RURAL	36.53	55.41
SOUTH		
URBAN	42.26	95.52
RURAL	2.19	73.14

SOURCE: IBGE, 1978.

CHAPTER FOUR:

THE MARKET FOR ANIMAL FEED RATIONS

MEAT PRODUCTION

Brazil is one of the main beef producers in the world, and has a cattle stock of over 127 million animals. Although the South and the South East together are the main beef producers, the Center West is the single most outstanding beef production area. The North East and the North have lowest beef production figures (Table 4.1).

Beef, as well as swine production has remained relatively stable over the last 15 years, with the notorious exception of the Center West region. The stagnant situation in beef and swine production is strongly related with the dynamic growth of the poultry sector in the same time lapse.

Brazil is the world's third largest producer of poultry meat and produces some 7% of total world market supply. From the beginning of the seventies the poultry industry has been growing at an extremely high rate, even for Brazilian standards. From 1970 to 1975 production increased with 139%. The Brazilian government became enthusiastic with these growth figures and did make a decisive effort to open export markets.

From 1975 Brazil has been exporting poultry, first only 3.4 thousand tons per year but afterwards reaching volumes of 280 thousand tons per year, equal to some 270 million dollars (Table 4.2). In this period beef and pork production stayed constant at respectively two million and half a

million tons, but poultry production rose from 413 thousand tons to 1.14 million tons (Table 4.3).

Simultaneously with the exports, domestic consumption of poultry increased rapidly. This was mainly due to the significant price decrease of poultry meat, as caused by quick technological change in poultry production. The shift to poultry consumption accounted for the complete increase in meat consumption. Consequently, beef and swine consumption per capita stayed relatively constant (Table 4.4).

DEMAND FOR ANIMAL FEED RATIONS AND MAIZE

Up to the sixties Brazil's industry of animal feed rations was relatively small and mainly directed to dairy cattle (IPEA, 1978). Swine production took place in small holdings, directed to the production of swine fat ("manteca") for baking purposes in the absence of a vegetable oil industry. Only in the beginning of the sixties, swine production on the basis of balanced animal feed rations started to take place. This was induced by the arrival of new hybrid swine races for meat production. From that moment on, the animal feed industry started to grow. Around the same time, the poultry industry got established, to take off with spectacular growth figures in the beginning of the seventies. Swine and poultry industry created an enormous demand increase for balanced animal feed (from 2.4 million tons in 1971 to 10 million tons in 1985, Table 4.5). This caused, in turn, a rapid modernization of the balanced animal feed and meat production industry, which by now has similar conversion rates to the United States.

The strong growth of balanced animal feed consumption created a rapidly increasing demand for maize. Maize is the

main animal feed raw material in Brazil and normally makes up 65% of the ration. In the last 15 years the consumption of maize by the animal feed industry increased from 8.4 to 15.7 million tons (Table 4.5).

Until the mid seventies, Brazil was a maize exporting country. Afterwards, internal demand increased so rapidly that Brazil had to start importing maize. Between 1977 and 1980 Brazil imported more than 4 million tons. Because of excellent maize harvests in the years between 1982 and 1984 Brazil could again export some maize, but the uprise was short. Due to prolonged drought in the Center West in 1985 and 1986, the country had to import more than 3.5 million tons in 1986 (Table 4.6).

THE POTENTIAL APPLICATION OF CASSAVA IN ANIMAL FEED RATIONS; A REGIONAL PERSPECTIVE

The large maize imports and the considerable subsidies on the transport of maize from the Center West oblige the government to look for alternative animal feed raw material sources. The utilization of dried cassava in stead of maize could contribute to the desired maize substitution. This alternative looks particularly viable in the North East, where soil and climate permit low cost cassava production, but almost completely prohibit maize production and reduce the potential of animal feed, poultry or swine production.

Table 4.7A shows the geographical distribution of cassava production, maize production and consumption, animal feed production and consumption, and poultry, eggs and swine (estimated) production and consumption. Cassava production is concentrated in the North and North East, especially on a per capita basis. Maize production is concentrated in the South and Center West, two regions that produce a

considerable surplus on top of their own consumption needs. As regards the production of balanced animal feed, again the South and Center West produce more than they actually consume. The North East on the other hand has large deficits of maize as well as animal feed availability.

The ample availability of feed grains in the South and Center West has also led to a concentration of poultry, swine and eggs production in these regions. Especially in the South poultry and swine production is very high. In this region per capita poultry and swine production is two and a half times as high as consumption. The surplus poultry production is to a great extent exported, while the surplus swine production is sold in other regions of the countries, mainly the South East. The relative high animal production levels in the South East are based on the cheap transportation of maize and animal feed from South and Center West to this region.

In the North East production levels of poultry, eggs and swine are less than halve the levels of the South East or the Center West and less than 20% of the level of the South. To satisfy the demand for these products in the regions, considerable amounts of poultry and swine are brought in. Still, consumption of swine, eggs and poultry is much lower than it is in the South or South East. Besides the effect of the lower incomes per capita, the reduced consumption levels in the North East are also caused by the higher prices for swine, poultry and chicken. During 1981 and 1982 consumer prices of swine, poultry and eggs were on average 10% higher in the North East than in the South.

As shown in Table 4.7B, the North East runs deficits of 22 to 44% on its maize consumption, its animal feed consumption and its poultry, egg and swine consumption. Additionally the low availability of locally produced poultry, swine and eggs

has increased their prices and has diminished their consumption. In the South East there is also a deficit on maize, animal feed and egg, poultry and swine availability but it is much smaller as a percentage of total consumption.

The previous analysis suggests that dried cassava production in the North East might be an appropriate way to improve the region's self-sufficiency rates in feed grains, animal feed and animal products. Additionally production of dried cassava would widen the market perspectives for the small farmer. Since the traditional market, for "farinha da mandioca," has strongly suffered throughout the seventies and early eighties from the wheat subsidies, an alternative cassava market would be very welcome.

LINEAR PROGRAMMING FEED COST MODELS

To find the most efficient composition of balanced animal feed, linear programming models are commonly used. These models try to determine which combination of feed stuffs fulfils the nutritional requirements of the animals diet at the lowest cost. These models have been used in the present study to define at which price level (as a % of the maize price) dried cassava would start to substitute for maize (Table 4.8).

At 74% of the maize price, dried cassava would form 8% of the balanced poultry ration. If the cassava price were to be reduced to 70% of the maize price, dried cassava would enter in the poultry diet with a participation of 10%.

In swine diets, cassava's potential is still much larger. Already at a price of 87% of the maize price, cassava would form 17% of the balanced swine ration. If the dried cassava price were to be reduced to 79% of the maize price, it would form around 30% of the diet.

At the moment the sales price of maize is around 1.69 Cruzados per kg. This means that at a price of 1.46 Cruzados per kg. dried cassava would enter in swine rations and at a price of 1.25 Cruzados per kg. it would enter in poultry rations.

ADVANTAGES FOR THE FARMER

At present, for the small farmer in the North East, farinha production forms one of the most important income sources. However, the income obtained in this way is highly variable because farinha prices are very unstable. Table 4.9 shows the instability of farinha prices in a number of urban markets: prices appear to have moved from below 1 to over 5 Cruzados per kg..

Most farinha price instability has been caused by supply variations. Since the farinha price-elasticity of demand is between 0 and -1, price fluctuations are always bigger than volume fluctuations. The volume fluctuations, in turn, are caused by the climatic fluctuations, that have such a heavy incidence on the agricultural sector of the North East.

Dried cassava as an animal feed would broaden the cassava market to the small farmer, which would have two positive effects on his income. Firstly, the use of cassava as an animal feed would diminish the price fluctuations, to which the farmer is subject in the farinha market. This is illustrated with Figure 4.1: If only the farinha market exists, random price fluctuations equal to $P_2 - P_1$ exist. If the cassava market is broadened with the animal feed market, the effective demand for cassava becomes more elastic and price fluctuations will be reduced to $P_3 - P_2$. This in turn stabilizes the farmer's income.

Secondly, with a new market the income from cassava sales would be increased. Figure 4.1 shows that before the opening up of the new market the expected income of the farmer is given by $Y1 = E(P) * Q(f)$. When the animal feed market would be opened up the expected income would be equal to $Y2 = E(P) * Q(r)$.

Besides the effect on the income of the farmer, the capacity to generate rural employment in cassava processing would be enhanced. This would be very welcome in the North East where rural unemployment and urban migration are high. There is no doubt that expansion of cassava production in order to supply the animal feed industry would have a very favorable effect on small farm income and rural employment.

TABLE 4.1

ANIMAL STOCK BY REGION

	SOUTH	SOUTHEAST	CENTER WEST	NORTHEAST	NORTH

(Million Units)

BEEF					
1973	20.6	32.5	19.5	15.9	2.0
1980	24.6	35.1	33.7	21.9	3.7
1984	24.3	35.0	40.8	21.7	5.9
SWINE					
1973	16.4	7.7	3.5	8.9	1.1
1980	15.4	6.1	2.9	8.0	1.9
1984	12.4	5.9	3.5	7.6	3.0
POULTRY					
1973	86.7	114.1	16.4	45.7	8.7
1980	152.1	181.7	20.1	72.5	15.0
1984	128.5	105.7	12.7	47.5	12.4

SOURCE: ANUARIO ESTATISTICO DO BRASIL (IBGE)

TABLE 4.2

EXPORTS OF POULTRY MEAT (1975 - 1984)

	POULTRY (tons)	VALUE (US\$)
	(Millions)	
1975	3.47	3.28
1976	19.64	19.56
1977	32.83	31.57
1978	50.81	46.87
1979	81.10	81.14
1980	168.71	206.69
1981	293.93	354.29
1982	301.79	285.47
1983	289.30	242.21
1984	280.00	270.00

SOURCE: AGROANALYSIS, FGV, Vol 8(10), Oct. 1984

TABLE 4.3

PRODUCTION OF MEATS (1976 - 1984)

	BEEF	SWINE	POULTRY
	(thousand tons)		
1976	2176	542	413
1977	2255	462	447
1978	2143	566	587
1979	2114	611	713
1980	2084	699	914
1981	2115	709	1049
1982	2397	626	1192
1983	2365	647	1204
1984	2161	567	1146

SOURCE: ANUARIO ESTATISTICO DO BRASIL (IBGE)

TABLE 4.4

ANNUAL PER CAPITA CONSUMPTION OF MEATS (1962 - 1984)

	BEEF	SWINE	POULTRY
	(kilograms)		
1962	17.5	7.8	0.1
1967	17.1	7.7	0.4
1972	19.0	7.9	1.5
1977	20.7	7.4	4.2
1981	23.7	7.9	10.2
1984	22.6	7.4	10.9

SOURCES: ANUARIO ESTATISTICO DO BRASIL (IBGE)
LUIS SANINT (OP. CIT.)

TABLE 4.5

DEMAND ESTIMATIONS FOR ANIMAL FEED RATIONS AND MAIZE (1971 - 1985)

	FEED RATIONS			MAIZE		
	POULTRY	SWINE	TOTAL	POULTRY	SWINE	TOTAL
	(thousand tons)					
1971	2149	316	2465	1397	7021	8418
1975	4136	821	4957	2688	7375	10063
1982	8828	2512	11340	5738	8558	14296
1985	10816	2671	13487	7030	8670	15700

SOURCES: IPEA, "Tecnologia Moderna para a Agricultura", Vol 3, 1978.
Luis Sanint, "Produccion de Carnes en el Brasil", unpublished report, CIAT 1985

TABLE 4.6

SUPPLY, DEMAND, AND NET IMPORTS OF MAIZE (1977-1986)

	77/78	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86
(Thousand Tons)									
SUPPLY:									
INITIAL STOCK	901.0	1.0	334.2	1180.0	1362.7	1823.4	823.5	2121.0	2441.9
PRODUCTION	14016.7	16513.2	19484.8	21282.7	21603.7	19014.1	21177.5	21173.9	19870.1
IMPORTS	1500.0	1520.0	2011.0	—		465.0		200.0	3573.0
TOTAL	16417.7	18034.2	21830.0	22462.7	22966.4	21302.5	22001.0	23494.9	25885.0
DEMAND	16416.7	17700.0	20600.0	21100.0	20600.0	19740.0	19700.0	21053.0	22154.0
SURPLUS	1.0	334.2	1230.0	1362.7	2366.4	1562.5	2301.0	2441.9	3731.0
EXPORTS					543.0	739.0	180.0		
FINAL STOCK	1.0	334.2	1230.0	1362.7	1823.4	823.5	2121.0	2441.9	3731.0
NET IMPORTS	1500.0	1520.0	2011.0	0.0	-543.0	-274.0	-180.0	200.0	3573.0

SOURCE: COMPANHIA DE FINANCIAMENTO DA PRODUÇÃO, (CFP).

TABLE 4.7A:

BRAZIL: THE GEOGRAPHICAL DISTRIBUTION OF CASSAVA PRODUCTION, MAIZE PRODUCTION AND CONSUMPTION, ANIMAL FEED PRODUCTION AND CONSUMPTION, POULTRY, EGG AND SWINE PRODUCTION AND CONSUMPTION, BY REGION, 1983

TOTAL:	CASSAVA PRODUCTION (000 TONS)	MAIZE PRODUCTION (000 TONS)	CONSUMPTION (000 TONS)	ANIMAL FEED PRODUCTION (000 TONS)	CONSUMPTION (000 TONS)	POULTRY PRODUCTION (000 TONS)	CONSUMPTION (000 TONS)	EGGS PRODUCTION (000 TONS)	CONSUMPTION (000 TONS)	SWINE PRODUCTION (000 TONS)	CONSUMPTION (000 TONS)
NORTH	3523.70	279.30	260.00	44.70	73.39	48.89	49.07	22.50	31.52	54.60	45.58
NORTHEAST	10382.72	900.00	1608.00	701.25	900.50	120.00	228.02	123.34	141.03	214.87	321.33
SOUTHEAST	2837.46	6080.90	7293.00	4526.73	4666.67	670.00	687.26	491.42	498.32	249.81	540.71
SOUTH	4055.01	10343.10	9743.00	5450.07	5106.49	764.00	297.24	228.67	189.73	589.72	243.01
CENTERWEST	947.19	2395.10	836.00	355.94	325.17	65.18	67.97	41.76	47.08	97.94	56.32
	PER CAPITA: (KG)	(KG)	(KG)	(KG)	(KG)	(KG)	(KG)	(KG)	(KG)	(KG)	(KG)
NORTH	536.33	42.51	39.57	6.80	11.17	7.44	7.47	3.42	4.80	8.31	6.94
NORTHEAST	276.06	23.93	42.75	18.65	23.94	3.19	6.06	3.28	3.75	5.71	8.54
SOUTHEAST	50.13	107.44	128.85	79.98	82.45	11.84	12.14	8.68	8.80	4.41	9.55
SOUTH	201.94	515.09	485.21	271.42	254.31	38.05	14.80	11.39	9.45	29.37	12.10
CENTERWEST	110.78	280.13	97.78	41.63	38.03	7.62	7.95	4.88	5.51	11.45	6.59

TABLE 4.7B:
 BRAZIL:
 REGIONAL SURPLUSES (+) OR DEFICITS (-) IN MAIZE,
 ANIMAL FEED AND POULTRY, EGG AND SWINE
 AVAILABILITY

	MAIZE (000 TONS)	ANIMAL FEED (000 TONS)	POULTRY+EGG +SWINE (000 TONS)
NORTH	19.30	-28.69	-0.18
NORTHEAST	-708.00	-199.25	-232.17
SOUTHEAST	-1212.10	-139.94	-315.06
SOUTH	600.10	343.58	852.41
CENTERWEST	1559.10	30.77	33.51

AS A % OF TOTAL CONSUMPTION:

NORTH	7.42	-39.09	-0.14
NORTHEAST	-44.03	-22.13	-33.63
SOUTHEAST	-16.62	-3.00	-18.25
SOUTH	6.16	6.73	116.77
CENTERWEST	186.50	9.46	19.55

TABLE 4.8

UTILIZATION OF DRIED CASSAVA IN ANIMAL FEED RATIOS
BASED ON MINIMUM COST FEED MODELS

	% MAIZE*	CASSAVA PRICE/ MAIZE PRICE**	% MAIZE	% DRIED CASSAVA
HENS (LAYERS)	52.35%	73.62%	44.39%	7.99%
	52.35%	70.41%	44.72%	9.96%
PIGS (60/100 Kg)	52.29%	86.45%	38.80%	16.77%
	52.29%	78.72%	26.96%	30.48%

(*): Cassava utilization artificially restricted to 0 (RHS=0).

(**): Maize price = 1.69 Cz./kg.

TABLE 4.9

CASSAVA FLOUR REAL PRICES (BASE YEAR=1977)

	PORTO ALEGRE	SAO PAULO	RIO	SALVA- DOR	FORTA- LEZA
	(Cr\$/kg)				
1969	2.56	3.25	2.13	3.65	1.96
1970	2.72	3.09	2.53	4.46	4.77
1971	3.16	4.39	3.45	6.02	3.83
1972	3.82	4.54	3.47	5.48	3.08
1973	3.43	3.92	3.29	4.30	2.93
1974	3.49	4.49	2.81	3.48	3.60
1975	4.90	5.89	3.31	7.13	4.42
1976	6.75	8.41	6.92	9.11	4.74
1977	5.24	6.33	6.79	2.05	4.11
1978	3.88	4.56	0.72	1.61	3.15
1979	3.73	4.11	0.69	1.86	3.66
1980	5.34	5.12	0.84	1.38	5.15
1981	4.51	4.97	1.14	1.35	5.68
1982	3.13	3.75	3.40	4.31	3.76
1983	2.83	3.13	2.87	2.54	3.17
1984	5.15	5.09	5.14	5.48	5.15

SOURCE: ANUARIO ESTATISTICO DO BRASIL, IBGE

4A: The effect on price stability

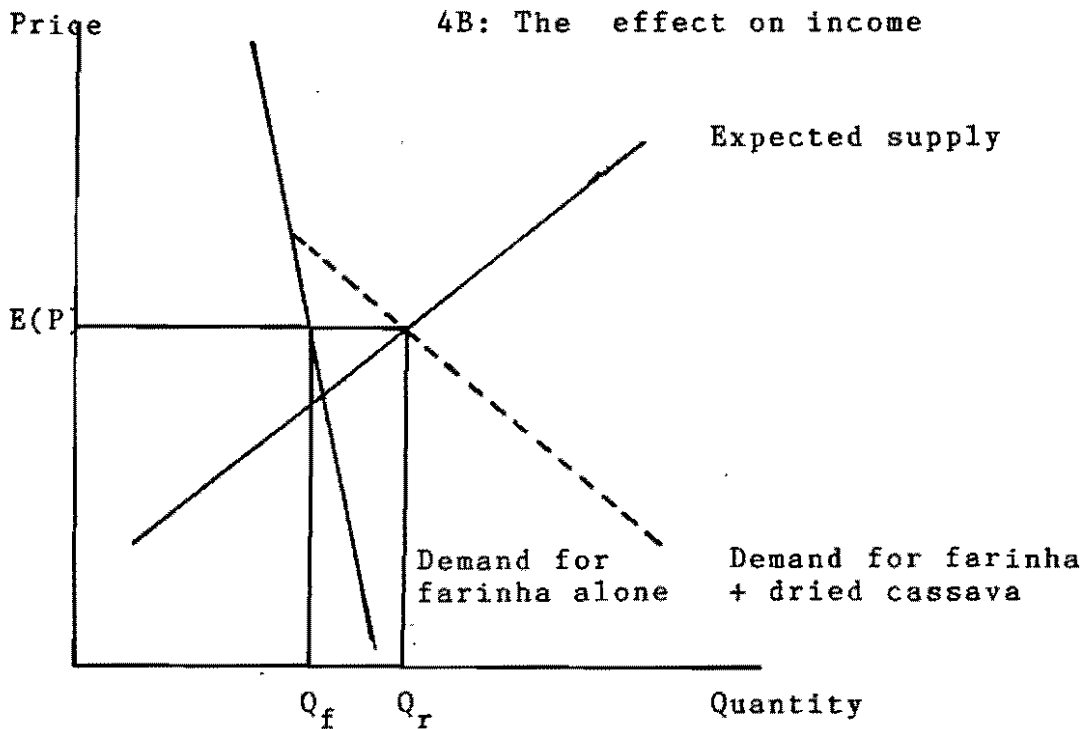
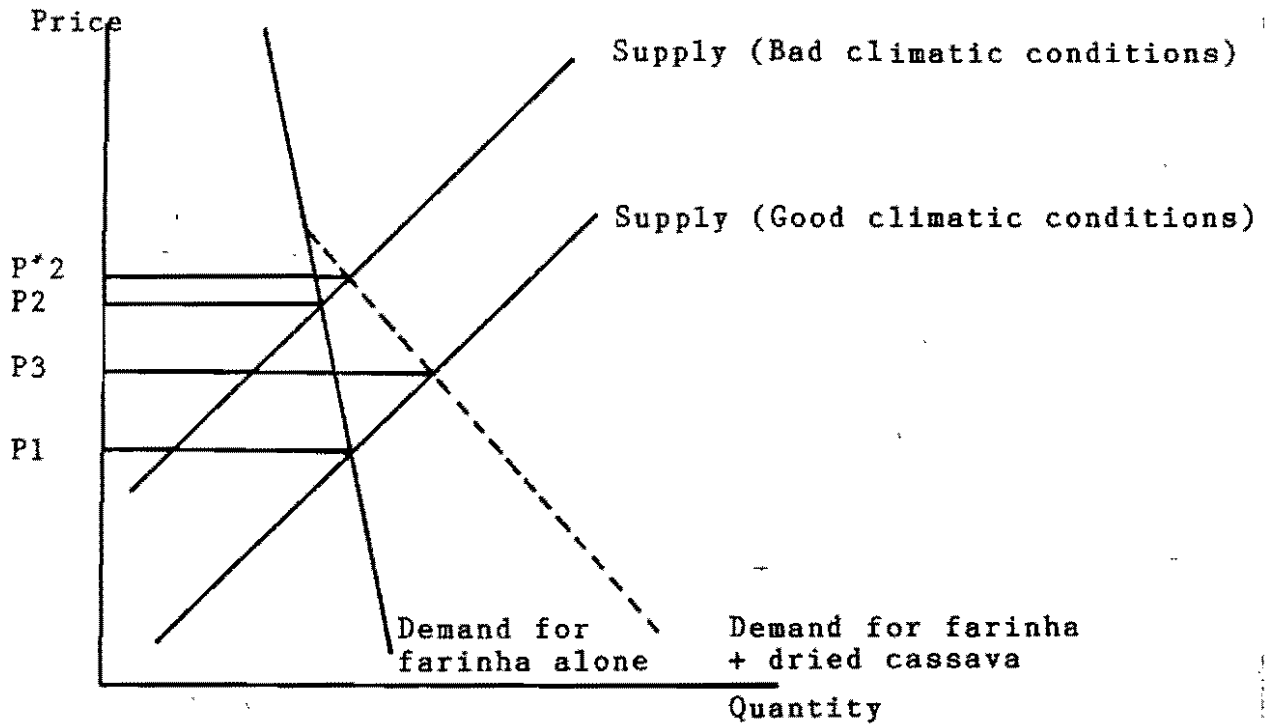


Figure 4.1: Impact of opening the dried cassava market on prices and incomes

CHAPTER V

THE SUPPLY OF CASSAVA

Cassava is grown in all the states of Brazil. The 1985 statistics of the IBGE indicate that 1.87 million ha were planted with a total production of 23 million tons, valued at 1.87 billion Cr\$. The agricultural census of 1981 estimates that cassava is the eighth most important crop in terms of area planted and the seventh in terms of value (Table 5.1).

CREDIT

In spite of the fact that cassava has frequently been named as a priority crop by the government the principal policy instrument to increase agricultural production, credit, has barely reached the cassava farmer. The production credit for cassava in the last 15 years was only 1.2% of the total (Table 5.2). As mentioned earlier the government stimulated the export crops; soya received 22% of the total credit. In addition the crops that played a role in import substitution like sugarcane (to produce alcohol to replace oil) and wheat received more than 20% of the total. This emphasis obviously reduced the governments ability to respond to the needs of basic food crops such as rice, beans and cassava that received less than 16% of the total production credit.

On a regional basis the farmer survey showed that in the North East only 28% of the farmers received credit for cassava production. The figures of the South East, North and South are 17%, 10% and a mere 5% respectively (Table 5.3).

The principal constraint on obtaining credit, as seen by the farmers, is the excessive bureaucratic requirements of the banks. These include guarantees, land titles and a multitude of other papers.

Less than 3% of the farmers received marketing credit. Forty percent of the farmers were not aware of the existence of the minimum price program and 20% of the farmers said that the appropriate agencies would not buy their produce as they had no storage space.

TRENDS IN CASSAVA PRODUCTION

In the last 15 years the total area planted to cassava has remained relatively constant at close to 2 million ha (Table 5.4). Production has however decreased by 6.4 million tons (22%) in the same period. This is due to a shift of production from the Center and Southern regions to the North and North East (Table 5.5).

In order to increase agricultural exports in the decade of the seventies, a strong program was set up to support the production of soya. The result was an expansion in area planted to soya from 1.2 million ha to 9 million ha, mainly in the South of the country. Cassava was displaced towards the North East. The Center and South produced over 50% of the cassava in 1964/66 whilst the North East produced only 38.5%. By 1983/85 the North East accounted for 57% of production and the Center and South for less than 30% (Table 5.5).

The climatic and soil conditions of the North East are much harsher than those of the Center and South and as a result yields are lower. In the South 7 out of every 10 years are considered as favorable for cassava production whereas in

the North East only 4 out of ten are. Furthermore even in good years the yields in the North East are lower (Table 5.6)

CASSAVA PRODUCTION SYSTEMS IN THE DIFFERENT REGIONS

The myth has arisen that cassava is essentially a subsistence crop with almost all the production being used to feed the farmers that produce it. It is indeed an important source of calories for the farmer and his family, however, the view of cassava as a subsistence crop distorts the reality; cassava plays an important role as a generator of small farm income.

The production systems that are used differ widely depending on the region. There is obviously some variation in production systems within the various regions, however this is less than the variation between regions. In this chapter the most important characteristics of each of the production systems in the different regions are outlined. Nevertheless, one outstanding and uniform feature of cassava throughout the country is that it is essentially a small or medium sized farm crop (Table 5.7).

The North

The North of Brazil is commonly known as the "Rural Frontier". It is characterized by large reserves of virgin forest that form the largest potential area for agricultural expansion in the country. According to the 1980 agricultural census 70% of the farms are of less than 50 ha with a further 12% between 50 and 100 ha (Table 5.7). These figures are however suspect. In the survey of cassava farms it was practically impossible to find farms of less than 50 ha.

Due to the great availability of land in the area farmers have increased the size of their holdings and the small farms in the region should be considered as those of 50 to 300 ha. These farms have a very narrow financial base, low availability of labor and are supported by minimal infrastructure. These smaller farms dedicated to the production of food and fruits coexist with very large holdings of 1000 ha or more that produce perennial crops such as rubber, forest crops and fruits. The lack of a dry period in this area makes it apparently favorable for agricultural production, however the fragile nature of these inherently infertile soils that rapidly degrade when the forest is cleared make sustained agricultural production difficult. In addition the region is prone to periodic flooding. Cassava is the pioneer crop in the region that allows colonizers to get started and then diversify their relatively large holdings with the inclusion of other crops in their production system; of the farms between 50 and 100 ha cassava planting averages 5.6 ha and occupies 80% of the crop area. It is generally planted as a monocrop or with maize or rice (Table 5.8). Over 90% of the production is destined to be converted to farinha (Table 5.9).

Farinha is the basic staple of the region. Grains are difficult to produce and dry in the humid environment and can only be imported to the region at great expense due to the distance from the production sites and also the poor infrastructure in general. The farinha of this area is different from that of the North East: it is fermented before toasting, has a yellow color and is known as farinha d'aqua. This farinha d'aqua is a principle source not only of food but also of cash for the smaller farmers of the region who sell into the small markets developing in the villages that are springing up in the region.

The North East

The North East is characterized by large areas of under utilized land and disparity in the farm size distribution. Six percent of the farms are greater than 100 ha whilst 67% of the holdings are less than 3 ha (Table 5.7). The most fertile soils with the more favorable rainfall distribution are on the coastal strip and further inland there are large cattle ranches interspersed with small farms dedicated mainly to the production of cassava. The region has traditionally been considered as the major farinha producing area in Brazil.

Cassava is produced mainly by small farmers who plant an average of 2.4 ha. It is their most important crop occupying 69% of the cropped area. The cassava is harvested continuously from the time when it is less than one year old with most harvested by the time it is two years old (Table 5.10). Most of the harvest (69%) is used for farinha production, with smaller amounts (29%) sold either as aipim (fresh cassava) or for farinha production and minimal quantities (3%) used for animal feed (Table 5.9).

The continuous harvesting of cassava for the production of farinha provides the farmer and his family with a steady food supply. Furthermore the ability to harvest over time is used by the farmers to obtain a regular cash flow (Table 5.10). This factor is of particular importance for the smaller farmers of this region who have historically had little access to credit.

The South East

In an agricultural context, the South East is a transition area between the North East and the South. Land distribution

is such that the majority (70%) of the land holdings are less than 50 ha with a typical farm being 25 ha (Table 5.7). Cassava production is concentrated on the areas that border the North Eastern States. Climatic conditions are similar to those of the North East but rainfall patterns are less variable and total rainfall tends to be greater.

The region is highly industrialized and infrastructure is well developed. Cassava is mainly used for farinha production and to a lesser extent as a source of starch for the industry.

The South

The southern region is characterized by a relatively uniform pattern of land distribution; 88% of the farms are of less than 50 ha with an average size of about 25 ha (Table 5.7). The soil and climate are favorable for agricultural production and infrastructure is well developed, especially for the handling of grains and animal products. The agriculture of the region is notable for the preponderance of small and medium sized farms, intensive use of the available land for the production of grains and grain legumes, and the production of pigs and dairy products (Tables 5.8, 5.9, 5.11). Cassava fits into the system mainly as a livestock feed (Table 5.12) due to its high productivity per unit area, its low production costs and its low capital requirements. In general about 80% of the cassava is used as animal feed, however whereas in Rio Grande do Sul this is for dairy, in Santa Catarina it is mainly fed to pigs. The remainder of the cassava is used as food on the farm or sold as aipim (fresh cassava). Farmers consider cassava to be their most important crop in terms of home consumption and for animal feed (Table 5.10). The average farm which uses cassava as an animal

TABLE 5.1
 BRAZIL - MAIN AGRICULTURAL PRODUCTS, IN ORDER OF MONETARY VALUE
 INCLUDING AREA, PRODUCTION AND YIELD.
 (1980)

Products	Area (Ha)	Production (Ton)	Yield (Kg/Ha)	Value (Thousand Cr\$)
TEMPORARY CROPS				
SOYBEAN	8,774,023	15,155,804	1,727	132,636,930
SUGAR-CANE	2,607,628	148,650,563	57,006	110,737,618
CORN	11,451,297	20,372,072	1,779	119,586,810
COFFEE	6,243,138	9,775,720	1,565	98,059,130
PEANUS	4,648,409	1,968,165	423	57,600,228
MAIZE	2,015,857	23,465,649	11,640	67,280,181
COTTON	1,353,443	1,439,330	1,063	29,306,153
WHEAT	3,122,107	2,701,613	865	29,205,648
POTATO	181,084	1,939,537	10,710	22,805,924
TABACCO	316,427	404,660	1,279	12,994,864
PERMANENT CROPS				
CAFFEY	2,433,604	2,122,391	872	88,248,110
ORANGE *	575,249	54,459,072	94,670	32,162,469
COCA	482,521	319,141	661	22,897,127

*) Production = thousand fruits and yield = fruits/Ha.
 SOURCE: FIBGE.

feed consumes 7-12 tons for cattle feed and about 14 tons as pig feed.

In this region the vast majority of the farmers (83%) grow cassava as a monocrop on an average area of 2.6 ha which corresponds to about 17% of their total land area (Table 5.8). Most of the cassava is harvested between 12 and 18 months and is available to feed livestock throughout most of the year (Table 5.11).

TABLE 5.2

PARTICIPATION OF CASSAVA
IN THE PRODUCTION CREDIT IN BRASIL (1972/1984)
REAL VALUES, BASE YEAR=1977

	GPI	CREDIT CASSAVA	TOTAL	PERCENTAGE
(IN MILLIONS OF CRUZEROS)				
1972	26.25%	237	17740	1.34%
1973	30.15%	195	23841	0.82%
1974	38.81%	159	33585	0.47%
1975	49.63%	224	43669	0.51%
1976	70.10%	342	52306	0.65%
1977	100.00%	536	90879	0.59%
1978	138.74%	421	87888	0.48%
1979	213.53%	1432	91675	1.56%
1980	427.47%	2057	96490	2.13%
1981	897.30%	2404	93044	2.58%
1982	1753.74%	1446	98740	1.46%
1983	4463.80%	758	71754	1.06%
1984	14311.70%	803	51509	1.56%
AVERAGE				1.17%

CREDIT DISTRIBUTION BY CROP
(AVERAGE 1975/1985)

CROP	%
SOYBEAN	22
RICE	14
WHEAT	12
COFFEE	11
SUGAR CANE	9
MAIZE	8
COTTON	6
CASSAVA	1
OTHERS	18
TOTAL	100

SOURCE: ANUARIO ESTATISTICO DO BRASIL

TABLE 5.3

USE OF CREDIT PROGRAMS FOR CASSAVA

	SOUTH	SOUTHEAST	NORTHEAST	NORTH

PRODUCTION CREDIT:				
GOVERNMENT BANK	5%	17%	28%	10%
PRIVATE BANK	1%	7%	1%	
WITHOUT CREDIT	94%	76%	71%	90%

REASONS NOT TO USE CREDIT:				

HIGH INTEREST RATES	25%	14%	11%	26%
TOO MANY PROCEDURES	5%	14%	22%	42%
TIMING PROBLEMS	1%	6%	7%	20%
CREDIT WAS DISAPPROVED			3%	8%

MINIMUM PRICE PROGRAM:				
STORAGE OPTION	3%		1%	
SALES OPTION		1%		
NO PARTICIPATION	97%	99%	99%	100%

REASONS NOT TO PARTICIPATE:				

MINIMUM PRICE BELOW COSTS OF PRODUCTION	3%	13%	15%	33%
INTERVENTION OFFICE DID NOT PURCHASE	17%	15%	27%	26%
DO NOT KNOW PROGRAM	40%	46%	42%	37%

SOURCE: CASSAVA SURVEY, 1986.

TABLE 5.4

CASSAVA PRODUCTION AND AREA HARVESTED TRENDS

	AREA (HA)	PRODUCTION (TON)
1970	2.024.557	29.464.275
1973	2.103.991	26.558.535
1976	2.093.638	25.443.053
1979	2.111.052	24.962.191
1982	2.122.029	24.072.320
1985	1.865.756	23.072.553

SOURCE: ANUARIO ESTATISTICO, IBGE

TABLE 5.5
PATTERN OF CASSAVA PRODUCTION
IN THE NORTHEAST AND CENTER-SOUTH
(TRI-ANNUAL AVERAGES)

	NORTHEAST	CENTER-SOUTH
	(PERCENTAGE)	
1964/66	38.5	56.5
1967/69	42.4	52.7
1970/72	42.6	52.5
1973/75	45.7	48.5
1976/78	51.9	40.0
1979/80	53.9	35.4
1983/85	57.3	28.1

SOURCE: ANUARIO ESTATISTICO, IBGE.

TABLE 5.6

SUBJECTIVE FARMER'S APPRECIATION OF CASSAVA
PRODUCTION AND PRODUCTION CIRCUMSTANCES

	SOUTH	SOUTHEAST	NORTHEAST	NORTH
OF EVERY 10 YEARS, HOW MANY ARE:				
GOOD?	7 ANOS	3 ANOS	4 ANOS	4 ANOS
NORMAL?	2 ANOS	4 ANOS	3 ANOS	3 ANOS
BAD?	1 ANO	3 ANOS	3 ANOS	3 ANOS
WHAT IS YOUR YIELD PER HECTARE IN A:				
GOOD YEAR?	30 TN/Ha	16 TN/Ha	14 TN/Ha	18 TN/Ha
NORMAL YEAR?	23 TN/Ha	11 TN/Ha	9 TN/Ha	11 TN/Ha
BAD YEAR?	15 TN/Ha	7 TN/Ha	6 TN/Ha	5 TN/Ha
AVERAGE YIELD	27 TN/Ha	11 TN/Ha	10 TN/Ha	12 TN/Ha

SOURCE: CASSAVA SURVEY, 1986.

TABLE 5.7

DISTRIBUTION OF FARMS BY REGION AND SIZE

	TOTAL	S<10	10=S<50	50=S<100	S>=100
NORTH					
% of Farms	100.00%	35.77%	34.58%	12.07%	17.20%
Aver. Size	102	4	23	71	488
NORTHEAST					
% of Farms	100.00%	67.61%	20.72%	5.32%	6.18%
Aver. Size	36	3	23	68	420
SOUTHEAST					
% of Farms	100.00%	32.57%	39.53%	11.97%	15.71%
Aver. Size	83	5	25	71	399
SOUTH					
% of Farms	100.00%	39.44%	48.37%	6.12%	5.98%
Aver. Size	42	5	21	68	423

SOURCE: CENSO AGROPECUARIO, 1980. IBGE

TABLE 5.8

CASSAVA FARM CHARACTERISTICS

	SOUTH	SOUTHEAST	NORTHEAST	NORTH
AREA				
LESS THAN 10 HA	35%	25%	78%	
FROM 10 TO 50 HA	57%	41%	16%	
FROM 51 TO 100 HA	6%	14%	3%	49%
ABOVE 100 HA	2%	20%	3%	51%
AREA APPROPRIATE FOR CROPPING	20.6	12.5	- 4.5	50.3
AREA IN:				
CROPS	15.2	7.0	3.5	7.0
PASTURES	6.5	17.1	2.0	19.2
AREA WITH CASSAVA	2.6	3.8	2.4	5.6
CASSAVA AREA AS PERCENTAGE OF:				
AREA IN CROPS	17%	54%	69%	80%
AREA APPROPRIATE FOR CROPS	13%	30%	53%	11%
PERCENTAGE OF CASSAVA IN:				
MONOCULTURE	83%	87%	76%	55%
MIXED CROPPING	17%	13%	24%	45%

TABLE 5.9

DESTINATION OF HARVESTED CASSAVA

	SOUTH	SOUTHEAST	NORHTEAST	NORTH
FARINHA PRODUCTION	3%	53%	68%	91%
STARCH PRODUCTION	1%	36%	0%	1%
ANIMAL FEED	80%	2%	3%	6%
FRESH CASSAVA SALES	16%	9%	29%	2%

TABLE 5.10

AGE OF CASSAVA AT HARVESTING

	SOUTH	SOUTHEAST	NORTHEAST	NORTH
LESS THAN 12 MONTHS	36%	4%	20%	38%
FROM 12 TO 18 MONTHS	39%	51%	51%	49%
FROM 19 TO 24 MONTHS	20%	31%	24%	11%
MORE THAN 24 MONTHS	5%	14%	5%	2%
REASONS TO HARVEST AT DIFFERENT AGE:				
CASH FLOW	5%	27%	61%	58%
PRICE EXPECTATION	38%	10%	23%	10%

TABLE 5.11
MOST IMPORTANT FARM PRODUCTS

	SOUTH	SOUTHEAST	NORTHEAST	NORTH
MOST IMPORTANT PRODUCT FOR SALE	SOJA MAIZE MILK/PIGS	FRESH CASSAVA STARCH MAIZE	FRESH CASSAVA FARINHA BEANS	FARINHA RICE MAIZE
MOST IMPORTANT PRODUCT FOR ANIMAL FEED	CASSAVA MAIZE PASTURES	MAIZE CASSAVA PASTURES	NONE CASSAVA MAIZE	NONE CASSAVA MAIZE
MOST IMPORTANT PRODUCT FOR FAMILY NUTRITION	FRESH CASSAVA BEANS RICE	FRESH CASAVA FARINHA RICE	FARINHA BEANS FRESH CASSAVA	FARINHA RICE MAIZE/BEAN

TABLE 5.12
CASSAVA AS AN ANIMAL FEED IN THE SOUTH

	CATTLE			
	FATTENING DAIRY DOUBLE PURPOSE PIGS			
FARMS INVOLVED IN THE ACTIVITY:	16%	56%	45%	50%
NUMBER OF ANIMALS:	10	10	17	53
NUMBER OF MONTHS PER YEAR THAT CASSAVA IS USED:	7	7	8	9
DAILY INTAKE/ANIMAL: (KG/DAY)				
ROOT	3.71	3.51	2.95	1.32
GREEN MATTER	.83	3.38	3.57	
ANIMAL FEED CASSAVA CONSUMPTION/FARM/YEAR (TONS)				
ROOT	7.79	7.37	12.04	14.31
GREEN MATTER	1.74	7.10	14.57	

CHAPTER SIX:

PRIVATE AND SOCIAL PROFITABILITY OF CASSAVA PRODUCTION IN BRAZIL

PRIVATE PROFITABILITY OF CASSAVA PRODUCTION IN BRAZIL

Production costs and production systems differ greatly in Brazil. While in the North of the country all production activities are done manually, in the South cassava production depends strongly on tractor or animal power. In the same way, intercropping with maize and rice is common in the North, while in the rest of the country monoculture is the most common production system. Input use is also very variable. In the North inputs are zero, except for the use of maize and rice seed in the intercrop. In the North East inputs amount to 438 Cruzados per hectare, 8% of production costs. The major input costs is organic fertilizer, which is applied on average at a rate of three tons per hectare. In the South East input use is restricted to some insecticides, while in the South organic fertilizer is again a major input. Where used, tractors plus additional machinery make up from 12 to 21% of production costs. In production systems with animal traction, the oxen represent 6 to 13% of production costs. The marked differences in cost structure between cassava production systems can be appreciated in Table 6.1.

Except for the frontier areas of the North where land is still available practically for free, land costs represent 20 to 25% of production costs. Land costs are higher in the North East than in the South, which probably expresses the

effect of the very uneven land distribution in the first region.

Differences in cost structures are not that big as to conceal the dominating importance of labor in every production system. Labor is by far the biggest production cost component, varying from 47% in the South to 87% in the North. In Brazil cassava remains a crop with excellent opportunities to create employment. This is most true in the North and North East, where the presented labor costs correspond with a larger number of labor days than in the South because of the lower wages.

The profitability of the different production systems is not only determined by production costs, but as well by yields obtained and prices received. Yield levels tend to move up from North to South, with the extensively managed systems of the North yielding only 7.4 tons per hectare and the well managed systems in the South yielding over 20 tons. Yield levels tend to depend on the use of machinery, oxen or labor for land preparation. Manually prepared land yields less than oxen prepared land, which in turn yields less than mechanically prepared land. At the basis of the present material it is difficult to distinguish whether this is due to the way of preparation or to differences in land quality which gave way to different methods of preparation.

Price levels are comparable through the country, slightly above the minimum price of 348 Cruzados per ton, imposed by CFP. However, care has to be taken in the interpretation of these price levels. In the South of Brazil only 16% of the harvest is actually sold. When this cassava is sold for fresh consumption ("aipim"), its price is considerably higher, around 2000 Cruzados per ton. In the North only 2% is actually sold and most of the rest is used for on farm production of "farinha da mandioca." Although in the North

East and the South East larger parts of the production are sold, more than half of all the cassava produced is transformed or consumed at farm level. In the North, North East and South East cassava profitability is not only a function of yields, prices and production costs, but also of processing parameters and farinha prices.

The profitability of cassava given the aforementioned prices can also be appreciated in Table 6.1. Four indicators have been developed: Net income per hectare, Income attributable to land and labor, Income per day of labor and cost of production per ton. The net income per hectare is negative in the North and the North East and indicates that the value added in cassava cultivation does not allow complete remuneration of the factors of production. In the North the main reason for the negative net income would be the low yield levels. In the North East not the low yield levels but the high production costs cause the negative net income. In the South East and more so in the South the net income per hectare is positive and allows for area expansion or for future wage or land price increases. In fact, in the South the cassava area has been reduced over the last 10 years, but rural wages have already reached a level which is double the one of the North and North East.

The steady existence of cassava in the North East and the North can be explained by considering the income attributable to labor and land. Even in the North more than 2000 Cruzados per hectare are available for this purpose. This shows that although land and labor are not remunerated according to going market rates, the farmer does not stay without an income. Underpayment of family resources is a well known phenomenon in agriculture, partly explained by the problems that farmers and their families face in obtaining employment outside agriculture.

In fact, many farmers who own their land, will consider the cost of land as an integral part of their income. In that case the implicit income per day of labor would be higher than the going day wage in all cases except for the manual and oxen land preparation systems in the North East. Since it is doubtful whether a farmer would have an equal amount of employment as a day laborer, it becomes clear why cassava production stays a preferable option for many farmers.

The regional differences in the implicit income per day of labor are striking. Where in the North and North East the implicit income per day stays around 30 Cruzados, it has a value of some 51 Cruzados in the South East and of some 200 Cruzados in the South. The enormous regional development problem, with large inequality between South and North(East) of Brazil, finds an easy expression in the different implicit incomes.

Costs of production for cassava are considerably lower in the South than in the other regions. As a matter of fact, the production costs per calorie of cassava in the South are only about 40% of the production costs per calorie of maize. The on-farm swine feeding on the basis of cassava that takes place in the South has low feed costs and will leave comfortable profits to the cassava/swine producer. However, in a country with the size of Brazil, utilization flexibility is not only determined by costs of production, but also by the potential of cassava within the region to substitute for other products. This would open up particular possibilities for cassava in the North East: Although production costs for maize are low in this region, regional maize production only satisfies 55% of local consumption (see Chapter 4).

Reduction of production costs in the North is greatly dependent on improving the ratio of yield levels to labor

input. Yield levels might be increased by the introduction of fertilizers, or labor input might be decreased by the introduction of chemical weed control. Production cost reduction in the North has to be achieved simultaneously with improved sustainability of yield levels and production systems, in order to slow down frontier development.

In the North East there seems to be considerable scope for reducing production costs by introduction of more technified production systems and by improved management practices. Management improvements should mainly be directed to the reduction of labor costs. The negative effects on employment that this would have, could be easily offset by the increased effective demand that cheaper cassava would face. Decreased production costs could be of great significance to allow cassava to act as a maize substitute in order to reduce the maize deficit of the North East while simultaneously improving profitability to the producer.

In the South East, production costs at present are lowest in the here presented system with manual land preparation. The future feasibility of this system in the region is limited given the strong incentives for rural laborers to migrate towards the industrial centers, where wages are considerably higher. Therefore cassava production will have to take place in more mechanized systems, based on oxen or tractor power. The main reason for the relative high costs of production in this region are the low yield levels. Contrary to the North East as well as the South, farmers in the South East do not use (organic) fertilizer. Introduction of better soil fertility practices could be instrumental in increasing yields and reducing production costs.

In the South production costs are already very low. Production is intensively managed, input levels are high, yield levels are outstanding. Further cost reduction should

probably be realized by improving mechanization practices and by introduction of new varieties.

THE PROFITABILITY OF "FARINHA DA MANDIOCA" AND "POLVILHO" PROCESSING

"Farinha da mandioca" production is important in the North, North East and South East of Brazil. Farinha is mainly processed in small scale processing facilities, often at the farm. "Polvilho" or starch is an important product in the South East of the country where it is processed in plants with very varying sizes.

A rough calculation of variable "farinha da mandioca" processing costs is made in Table 6.2. At the assumption that 10 tons of cassava are needed to produce 3 tons of farinha, the raw material costs are equal to 1250 Cruzados per ton. Raw material accounts for 68% of variable farinha production costs and forms by far the biggest cost component. The second biggest cost component is labor, needed for peeling, chipping and other processing activities. This sums up to 420 Cruzados or 23% of variable farinha production costs. Inputs (petrol, firewood, packings) sum up to 160 Cruzados per ton, 9% of variable costs.

The calculation of starch processing costs can be found in Table 6.2 as well. Raw material costs are considerably higher than in the case of farinha, because the conversion of cassava into starch is less efficient than the conversion into farinha. Labor costs in starch production are also considerably higher. This involves peeling, as well rasping, straining and drying. Also fuel costs, to dry the starch, are high. However, since the price of starch is considerably

higher than the price of farinha, starch production remains a profitable activity.

Variable costs for farinha production are already higher than farinha prices, which implies that the remuneration to production factors has to be below going market rates. If fixed costs, which mainly consist of depreciation and interest on investments, are assumed to be zero, then labor can still be paid only at 76% of the market rate of the North East and South East. Labor in farinha production is to a great extent supplied by the women and children of the farm family. Their ability to find productive and better paid employment outside the farm is often minimal, and forces them to supply their labor below the market rate.

In the South East, cassava is in fact produced at some 60 Cruzados below the assumed costs of 375 Cruzados per ton. In this case the profitability of producing cassava compensates for the losses in farinha processing. Although cassava production looks like a profitable activity and cassava processing like an unprofitable activity, the integrated activity of production and processing breaks more or less even in this region. Additionally a nice profit can be made in starch processing.

In the North East the situation is less rosy. The net profitability of cassava production was shown to be negative, up to the extent that farmer owners, who do not reckon land costs, are still perceiving a daily income which is below the market wage rate. In this case the integrated activity of cassava production and processing maintains itself only because the income alternatives for the farmer and his family outside agriculture are reduced. Given the dominance of raw material costs in the total costs for farinha processing, the profitability of cassava production

and processing will be most rapidly improved by decreasing production costs.

THE DOMESTIC RESOURCE COSTS OF CASSAVA PRODUCTION IN BRAZIL

In Brazil, as in most other countries, internal prices are not freely formed in the confrontation of demand and supply, but are partly determined by existing subsidy and tax structures, as well as by existing market rigidities. Regarding costs, price deviations represent transfers of income by the rest of the economy to (in case of subsidies) or from (in case of taxes) producers. Considering output prices, subsidies imply a transfer to and taxes imply a transfer from producers. These price deviations imply that the private profitability of an activity is not necessarily equal to the profitability of the activity for the country as a whole. This complicates the understanding of which activities are most economically performed in the country, as regards among others the question of domestic production versus imports as well as the question of production of certain commodities versus their substitutes.

Therefore, apart from the private costs of cassava, it is useful to understand the social costs of cassava production (i.e. after correction for subsidies, taxes and market rigidities). This parameter, as calculated in Domestic Resource Costs analysis, indicates to what extent internal production of cassava is preferable to importation of cassava or its substitutes, or to what extent cassava production uses more or less resources than production of its substitutes.

International cassava trade to and from Brazil is practically zero, with the slight exception of some dried cassava that was incidentally exported to Western Europe in

the seventies. This means that the comparison of domestic cassava production with cassava imports is not very relevant. However, within the country cassava flour is a partial substitute for wheat flour, while dried cassava is a substitute for feed grains such as maize and sorghum.

PRODUCTION PERSPECTIVES OF CASSAVA FLOUR VERSUS WHEAT FLOUR

As regards the possible substitution of cassava flour for wheat flour, it is difficult to make a correct DRC-analysis due to the absence of reliable wheat production costs data. Also it is hard to estimate, to what degree the two products would actually substitute. Nevertheless some brief remarks on the substitution between wheat and cassava flour can be made: Since the beginning of the seventies, the wheat price is heavily subsidized in order to stimulate wheat production and to decrease the cost of the diet to the urban poor. 71% of the acquisition costs of wheat to the wheat mill are covered by a government subsidy, which results in a 65% subsidy of the price of wheat flour or a 38% subsidy of the price of bread. As a result of the wheat subsidy, cassava flour, which was 35% cheaper in 1970, became three times as expensive in 1980 (see Table 6.3). Without the subsidy cassava flour and wheat flour would have been in the same price range. Although the 1980 wheat flour/cassava flour price ratio still implies certain progress of wheat flour productivity versus cassava flour productivity, cassava flour consumption would probably not have dropped so quickly as it appeared to have done. The firmly established wheat subsidy policy has increased wheat production and has decreased the cost of the diet to the urban poor, but has done this at the cost of the income of the cassava farmer and processor.

PRODUCTION PERSPECTIVES OF DRIED CASSAVA AS AN ANIMAL FEED

Although production costs for cassava and maize in Brazil are affected by a number of subsidies and taxes, the potential for dried cassava to substitute maize and sorghum as animal feed raw material is not constrained by government interventions similar to those in the case of wheat. As written in Chapter Four the potential of cassava to substitute for maize looks best in the North East.

In 1986 maize was supplied in the North East from four areas. The first area of supply was the North East itself. Data of CFP (Companhia de Financiamento da Producao) for 1985, that were corrected for inflation, suggest production costs for local maize of around 1517 Cruzados per ton (see Table 6.4A). The second area that supplied maize to the North East is the South. Maize is shipped over sea from Parana to Pernambuco or Ceara and is mainly consumed close to the Coast line. The costs to supply this maize in the North East are around 1616 Cruzados per ton, 45% of which are transport costs. The third area which supplies the North East is the Center West, mainly the department of Goias. Maize from this area is transported by truck to those areas of the North East that cannot be easily reached from the ports. In 1986 this maize could be supplied at a cost of 2494 Cruzados per ton. Transport absorbs 50% of the costs of supplying this maize, due to the long distances, the bad road quality and the absence of return freight. Also maize was imported at a cost of approximately 1705 Cruzados per ton. Maize from the region as well as from the South would compete with CIF maize import prices, but maize from Goias would only find its way into the market through the minimum price schemes operated by CFP (this means buying at a price of 1480 Cruzados per ton in Goias, transporting to a deficit

region and selling at the going market rate, while absorbing the transport costs).

In the costs for supplying maize from the North East the incidence of capital is very high (see Appendix 2). This is due to the fact that these cost data were gathered when inflation and therefore interest rates were still galloping. If these production cost data would have been gathered after the establishment of the Plan Cruzado-I, other cost factors would have been higher while capital costs would have been lower. Because of the low yield levels (estimated at 1350 kg. per ha) land costs were also high.

Inputs form a considerable part of the cost of supplying maize for all the three systems studied. For maize from the North East, this takes almost 30%, for maize from the South and the Center West it takes respectively 40 and 60% of total supply cost. Fuel for transport or traction is a very important input to supply maize. Since Brazil is a net importer of energy, this implies a relative high cost to the country in terms of foreign exchange.

As part of the plan Cruzado-I, which tried to control the galloping inflation, maize prices were frozen in 1986 at a price level of 1483 Cruzados per ton. The difference between the frozen price and the actual costs of supplying maize was absorbed from the government's budget. This does not appear to be a long term policy and therefore has not been taken into account in the present analysis.

Although maize production is not subsidized in a similar way as wheat, the private costs of supplying maize do not form a true reflection of the social costs because of a number of taxes on inputs increase maize production and marketing costs. For example, although Brazil produces most of its tractors itself, this production takes place behind a tariff

wall of 30% on the CIF-value of every imported tractor. In a similar way there lays a duty of 50% ad valorem on most agrochemicals. Internal taxes on non tradeable inputs could further disrupt the picture of social versus private costs, but happened to be zero for all inputs considered. This means that costs have to be corrected mainly for the import duties on tradeable cost items in order to obtain an unbiased judgment on the social costs of maize production.

Correcting these costs is very complicated in the case of Brazil for a number of reasons. Brazil maintains some 28 different import regimes and it is very difficult to discover which import regime has been effective for a certain product. In the case of production behind a tariff wall, as in the case of tractors, the nominal duty might be higher than the real duty needed to protect the industry. Additionally, although it might appear that internal production of a certain commodity is inefficient in comparison with external production, abolishment of production might raise the request for foreign exchange so much that at the exchange rate that would result afterwards, production would have appeared to be efficient (a paradox similar to the one that can be found in defining a Pareto-optimum). Given these complications in Table 6.4B it has been tried to define the social costs of maize supply in the North East.

Maize can be supplied in the North East at a social cost of 1405 Cruzados when coming from the region, at a cost of 1467 Cruzados when coming from the South, at a cost of 2130 Cruzados when coming from Goias or at a cost of 1675 Cruzados when imported (Table 6.4). In the social costs of maize supply, inputs play a less dominating role, but still absorb up to more than 50% of total costs.

Dried cassava could be supplied in the North East at an approximate private cost of 1455 Cruzados per ton (Table 6.4A). Comparable shares of some 14% are needed to process fresh into dried cassava and to transport dried cassava to the consumer. The rest, over 70%, are production costs (Appendix 3). In the cost structure of cassava supply it draws the attention that more than 50% of the total costs is labor costs, while only 20% are input costs. Cassava is basically supplied by employing production factors and needs considerable lower input levels than maize.

After correcting the private costs for subsidies and taxes a social cost of cassava supply of 1379 Cruzados per ton results (Table 6.4B). The costs of supplying dried cassava in that case vary between 98% of the cost of local maize to 65% of the cost of maize from Goias. Since Brazil might well be importing maize in the coming years, the cost of supplying dried cassava versus the cost of supplying imported maize is especially relevant. This value is around 83%.

It should be taken into account that at the moment the farmer in the North East does not receive complete remuneration for his production factors. In the most profitable system the net income per hectare still stays 666 Cruzados negative. At the same moment processing labor only receives 76% of the market wage. If cassava supply costs are calculated not on the basis of market prices, but on the basis of the present remuneration of production factors, the supply costs as presented in the bottom of Table 6.4 result. In this case dried cassava could be supplied at 1306 Cruzados per ton, if calculating at private costs, or at 1231 Cruzados per ton if calculating at social costs. At private costs the cost of supplying dried cassava vary between 86 and 52% of the cost of supplying maize, at social costs they vary between 88 and 58%.

The competitiveness of dried cassava versus maize as a balanced animal feed raw material is summarized in Table 6.5. Linear programming models have shown before that dried cassava would be an efficient substitute for maize in layer hen rations at 74% of the maize price. That would make dried cassava competitive in comparison with maize from Goias or with imported maize, but in the last case only if calculated with shadow prices and opportunity costs of labor and land. Although dried cassava forms an attractive option from the national point of view, some government support (eg. credit subsidies on processing equipment, transport cost reduction) would be necessary to make it a viable option for the private enterprise. Dried cassava enters as a maize substitute in pig rations at 86% of the maize price. It would therefore be competitive with maize imported or brought in from Goias and, if calculated with opportunity costs for land and labor, with maize supplied from the South.

Regarding the competitiveness of dried cassava versus imported maize, it is important to consider the effect of the exchange rate. For every 10% that the exchange rate would go down, the price ratio of dried cassava versus imported maize would decrease with some 6%. The exchange rate of 14.2 Cruzados to the dollar that has been used in this study, was the official exchange rate in October 1986. However at the black market, the exchange was already almost double by that time. It does not look unrealistic to state that Brazil's exchange rate at the moment of analysis, was overvalued with at least 20%. In that case, dried cassava would be fully competitive with imported maize as an energy source for layer hen rations or any other balanced animal feed, also if production factors are paid at full market rate instead of their presently low opportunity costs.

Cassava already plays an important role as a fresh animal feed in the South of the country. It could also play an important role in the dried form in the North East of the country. There is obvious potential to form part of swine rations, but there also appears to be potential to participate in layer hen rations. Improved production technology, in order to decrease the cost of dried cassava would enhance this potential. Additionally it can be expected that increased feed availability would stimulate further growth of the animal feed and animal production sector, partly creating its own demand.

In former days, when Brazil was a residual exporter of maize, dried cassava production in the North East would have replaced maize from Goias, which would have been exported at a considerable loss. In that case production of dried cassava in the North East would have clearly invoked a regional development conflict between the North East and the Center West. At the moment, Brazil is not self-sufficient in maize production, and any increase in local production of maize or its substitutes would be welcome. Dried cassava would not only contribute to rural development of the North East, but would also allow Brazil to divert its scarce foreign exchange from maize to other products.

REGION	NORTH		NORTHEAST			SOUTHEAST		SOUTH	
PRODUCTION SYSTEM	MONOCULTURE MANUAL	CASSAVA/MAIZE/ RICE MANUAL	MONOCULTURE MANUAL	MONOCULTURE TRACTOR	MONOCULTURE OXENS	MONOCULTURE MANUAL	MONOCULTURE TRACTOR	MONOCULTURE OXEN	
PRODUCTION COSTS									
LABOUR	2275	2131,25	3483,75	3153,75	3075	2343,75	2000	2006,25	
INPUTS		125	438,75	438,75	438,76	29	324,5	324,5	
MACHINERY				700			910		
ANIMALS					330			375	
LAND	200	200	1000	1000	1000	1082	800	800	
INTERESTS	148,5	147,375	295,35	317,55	290,6256	207,285	242,07	210,345	
TOTAL PRODUCTION COSTS	2623,5	2603,625	5217,85	5610,05	5134,385	3662,035	4276,57	3716,095	
YIELD (TON/HA)									
CASSAVA	7,4	3	9,364	13,183	10,733	11,3	34,3	23,3	
RICE		0,48							
MAIZE		0,3							
PRICE (CRZ./TON)									
CASSAVA	350	350	375	375	375	375	350	350	
RICE		2000							
MAIZE		1630							
GROSS INCOME PER HECTARE	2590	2499	3511,5	4943,625	4024,875	4237,5	12005	8155	
NET INCOME PER HECTARE	-33,5	-104,625	-1706,35	-666,425	-1109,51	575,465	7728,43	4438,905	
INCOME ATTRIBUTABLE TO LABOUR AND LAND	2441,5	2226,625	2777,4	3487,325	2965,489	4001,215	10528,43	7245,155	
INCOME PER DAY OF LABOUR	26,82967	26,11876	23,91733	33,17312	28,93160	51,21555	263,2107	180,5646	
INCOME PER DAY OF LABOUR AS % OF MARKET WAGE RATE	107,3186	104,4750	79,72443	110,5770	96,43867	170,7185	526,4215	361,1292	
PRODUCTION COSTS PER TON	354,5270	N.A.	557,2244	425,5518	478,3737	324,0738	124,6813	159,4890	
COSTS PER CALORIE CASSAVA/MAIZE	0,940990	N.A.	1,010155	0,771455	0,867212	0,639709	0,317699	0,406392	

TABLE 6.2:
VARIABLE PROCESSING COSTS
OF FARINHA AND STARCH

	FARINHA PRODUCTION	STARCH PRODUCTION
RAW MATERIAL	1250	2250
FEELING	150	270
SHIPPING	100	180
OTHER SALARIES	170	420
PETROL	10	180
FIREFWOOD	70	0
PACKING	80	140
TOTAL COSTS	1830	3440
FARINHA PRICE/TON	1730	3660
LOSSES PER TON OF FARINHA CASSAVA/TON	-100	220
LABOUR PAYMENT/ DAY WAGE	0.76	1.25

TABLE 6.3: RELATIONSHIP BETWEEN FARINHA DA MANDIOCA AND WHEAT CONSUMPTION,
AND THEIR RESPECTIVE PRICES.

	1960	1970	1980
FARINHA CONSUMPTION (KG/CAP.)	26.3	23.5	12.0
WHEAT CONSUMPTION (KG/CAP.)	26.2	25.2	45.5
FARINHA/WHEAT CONSUMPTION	1.00	0.93	0.26
FARINHA/WHEAT PRICES	0.61	0.64	2.95

TABLE 6.4: PRIVATE AND SOCIAL COSTS OF SUPPLYING
MAIZE OR DRIED CASSAVA IN THE NORTHEAST
OF BRAZIL, 1986.

	6.4A: PRIVATE COSTS	6.4B: SOCIAL COSTS
LOCALLY PRODUCED MAIZE	1516.6	1404.8
MAIZE FROM THE SOUTH	1615.9	1467.5
MAIZE FROM CENTERWEST	2493.9	2130.1
IMPORTED MAIZE	1705.0	1675.0
LOCALLY PRODUCED DRIED CASSAVA	1455.1	1379.4
LOCALLY PRODUCED DRIED CASSAVA, FACTORS PAID AT OPPORTUNITY COSTS	1306.4	1230.7

FOR MORE DETAILED INFORMATION ON MAIZE AND DRIED
CASSAVA SUPPLY COSTS SEE APPENDICES 2 AND 3

TABLE 6.5: COSTS OF SUPPLYING DRIED CASSAVA AS A
PERCENTAGE OF THE COST OF SUPPLYING
MAIZE, NORTHEAST OF BRAZIL, 1986

	FACTORS IN CASSAVA PRODUCTION REMUNERATED AT MARKET WAGE		FACTORS IN CASSAVA PRODUCTION REMUNERATED AT OPPORTUNITY COSTS	
	PRIVATE COSTS	SOCIAL COSTS	PRIVATE COSTS	SOCIAL COSTS
LOCALLY PRODUCED FEED	96	98	86	88
FEED FROM SOUTH	90	94	81	84
FEED FROM THE NORTHEAST	58	65	52	58
IMPORTED FEED	85	83	77	73

NOTE: MAXIMUM PRICE RATIOS AT WHICH DRIED CASSAVA
FORMS PART OF BALANCED FEED:

LAYING HENS: 0.737 (7% PARTICIPATION)

PIGS: 0.865 (16% PARTICIPATION)

CHAPTER SEVEN

CONCLUSIONS: THE NEED FOR CASSAVA DEVELOPMENT IN BRAZIL

Cassava is an important crop in Brazil. It holds the eight place, as regards area planted and the seventh place regarding monetary value. After rice and sugar, it shares the third place with wheat, beans, oils and fats as a calorie provider to the Brazilian population. Cassava is especially an important crop in Brazil because it is grown mostly by small farmers and consumed mostly by poor urban or rural consumers. Therefore the crop can play a dominating role in equity oriented programs that aim to mitigate the effects of the skewed income distribution of the country.

The importance of cassava does not stem only from its monetary value, but possibly to an even larger extent from the specific functions it has performed and will perform within the Brazilian economy. One of these functions is the provision of a gradual, well spread cash flow to severely financially constrained farmers. This steady cash flow allows these farmers to purchase the daily life essentials through most of the year without having to borrow at often excessive rates.

Another function of cassava has been its availability in times of drought and famine. During the drought period from 1978 to 1983 in the North East of the country, cassava was for many people the first and often only relief from starvation. For the government it was one of the buffers against social unrest.

A third important function stems from its ability to grow in marginal agroecological conditions (regarding soils as well

as climates). In many parts of the North East it forms the only viable crop for the peasant population, in the North of the country it allows the colonizers a readily accessible calorie source to survive the first tough years of opening up the land.

Finally, because of its high yield potential per hectare, it forms an extremely cheap calorie source for on farm animal feeding, mainly in the South of the country. Here the availability of high yielding cassava has allowed small and intermediate farmers to intensify their agricultural operations, venturing into export crops such as soya, as well as into pig production operations.

Brazil is the most important cassava producer of the world, but this position is apparently at risk because of the reduction in production that has taken place in the last 15 years. Between 1970 and 1985 production went down from 29 to 23 million tons, which means that per capita production was almost halved.

The urbanization process, which always tends to negatively affect rurally produced traditional staples, has been a first cause for the decreasing importance of cassava. In the rural areas of Brazil consumption levels of fresh cassava as well as farinha are about three times as high as in the urban areas.

The other reason for the decreasing importance of cassava can be found in the agricultural policies of Brazil. Most agricultural policies of Brazil have been directed towards export promotion (soya, cotton) and, in a later phase, import substitution (sugar cane and to a certain extent wheat). The most important policy instruments have been the provision of subsidized credit as well as the development of a minimum price support program. The direct budgetary costs

of these programs have not been excessive, certainly not compared to spending in USA or EEC agriculture, except for the case of wheat, where a price subsidy of over a billion dollars takes place. However, the emphasis on export crops came at the expense of domestic food crops. As a result growth in food supply in Brazil has been inadequate and the nutritional condition of the Brazilian population has been poor.

Low input crops such as cassava are naturally disadvantaged by credit subsidies, but additionally the amounts of credit available for cassava were very much smaller than those for eg. soya, cotton or maize. On top of that, most cassava farmers have problems to fulfil the official requests for credit. At the same time it appears that the minimum price programs for cassava (flour) have not been functioning well. These factors have led to large scale substitution of cassava by soya, especially on the fertile land of the South.

Moreover, the regional development policies pursued by the Brazilian Government did not favor cassava. Since the sixties and the foundation of Brasília most efforts have been directed towards the opening of the agricultural frontier in the Center West of the country. The South and South East, which had relatively high development levels anyway, could autonomously finance infrastructure expansion. They also benefitted from the spin-off from the development of the Center West and by the export oriented agricultural policy, directed to crops grown in the South. The North East, where cassava production was concentrated, not only was neglected but was adversely affected by regional policies in the rest of Brazil.

The knock-out blow for cassava in Brazil has been the wheat subsidy. Between 1970 and 1980 wheat prices decreased from

about equal to only a third of the farinha prices. Consequently wheat consumption doubled, apparently to a large extent at the cost of farinha consumption.

In the same way that the present status of cassava has been defined by agricultural policy, its future role will also be determined by policies. The question therefore is to what extent the existing policies can be expected to stay the same or to change in favor of or against cassava production and utilization.

In 1985 Brazil returned to a democratic government, after two decades of military rule. The new democratic government is more inclined to direct policies to those fields where the benefits for the electorate are largest. Among other objectives, adequate nutrition of the population and control of the previously galloping inflation will be stressed. For both reasons it is not expected that the wheat subsidy will be eliminated, but it might well be that other food products will receive more attention.

At the same time the democratic government is looking for development opportunities in the North East of the country where more than 35 million people are living. In collaboration with the World Bank a special program for the North East (SUDENE) has been established. Within this program cassava development could help to improve income prospects of the poor, rural farmer.

A third consideration for the Brazilian government is the continued scarcity of foreign exchange, mainly due to the large interest and debt service payments. Consequently the government is interested in autonomous development of its industrial sector and in maximum levels of agricultural self-sufficiency. The growth of the Brazilian animal feed industry up to the present has been mainly supported by

domestic maize production, incidentally supplemented with imported maize. In this respect it has responded satisfactorily to the government desire to save foreign exchange. However, it appears infeasible that maize supply will grow quickly enough to maintain the historic growth rate of the animal feed industry. Instead of importing maize, the government could decide to promote the use of dried cassava in animal feed rations. Apart from the positive effect on foreign exchange availability, this could shift the regional balance of animal feed production (and probably swine and poultry production and consumption) towards the North East.

The recent changes in the Brazilian political environment will have lasting effects on the government's policies. Issues that were neglected up to recently will start to receive more attention. The government will emphasize the development of the North East, will try to control inflation, will try to improve the nutritional status of the poor urban dweller and will do a thorough effort to cure its balance of payment problems. It can be concluded that the future for cassava in such an environment is more promising than in the past. In the same way it can also be concluded that cassava's potential to contribute to government policies is larger than in the past. However, to realize cassava's contribution towards development it is necessary to focus on the most appropriate ways of utilization.

Presently cassava is mainly utilized in four different forms in Brazil. The most important form of all is as farinha. Farinha consumption appears to have been declining over the last 15 years, basically because its relative price has become less competitive. It remains and will remain, however, a very important product for the Brazilian consumer, most so the very poor. Given the increasing

numbers of poor people in the Brazilian cities (the urban income distribution has become notably worse) it can even be shown that farinha demand at constant prices would have increased over the last ten years.

To improve the role of farinha as a staple food an integrated strategy is necessary. Increased per capita consumption will basically depend on better availability, better quality and lower prices. Therefore efforts should be undertaken to decrease the costs of cassava production and to streamline farinha processing and distribution. The distributive impact of cheaper farinha is considerable. Pachico (1981) calculated that 46% of potential benefits would accrue to the poorest 25% of the population. Williamson Gray (1982) calculates that of each dollar of subsidy spent on farinha 60 cents would be transferred to the poorest 30% of the population. For bread and rice those figures would only be 18 and 23 cents. Nutritional policies aimed at adequate dietary intake could be conveniently focused around farinha. Such a policy would have a relatively small leakage to more wealthy consumers and would be both cheap and effective.

The second traditional utilization has been as "aipim" (fresh cassava). "Aipim" consumption levels are under extreme pressure because of the exorbitant marketing margins that are charged (over 80%). For fresh cassava to play a larger role as a secondary staple or vegetable, it is necessary to diminish these marketing margins. The introduction of storage techniques, which might have an additional effect on "aipim" quality, will be critical for increased fresh consumption.

The third utilization of cassava in Brazil is as starch. Cassava starch is easily interchangeable with maize or sorghum starch and its competitiveness depends mainly on the

price/quality relation at which it can be supplied in the market. Since 65% of starch production costs are for raw material, the reduction of production costs becomes the critical factor. At the same moment ways in which costs of processing can be diminished or ways in which quality of the final product can be improved should be evaluated.

The fourth utilization is for on-farm animal feeding. It can safely be stated that the utilization potential for on-farm cattle and swine feeding in Brazil is immense. Realization of this potential is dependent on further reduction of costs of production, coupled to improved storage and feeding systems. Silage systems, such as presently developed in Mexico, might have special value for this purpose.

Apart from the existing end uses, the development of dried cassava production for animal feed purposes has great potential. Present production costs already allow the introduction of dried cassava in animal feed rations, but with improved production technology the benefits of dried cassava to both producers and consumers are going to be enormous. A dried cassava industry would diminish the need to import maize, would stabilize cassava on-farm prices and would greatly extend the market size for the crop. A rough estimate suggests that in the North East alone around 3.5 million tons of cassava per year could be used in animal feed.

The variety of end uses and the strong differences between the regions of the country allow and necessitate the development of specific regional cassava programs. As far as the North is concerned, it is expected that cassava will maintain its role as a settler's crop. Appropriate development of cassava hinges on striking the right balance between ecological considerations, such as yield sustainability and minimum erosion, and the colonist's

anxiety for land. In the North settlers occupy large areas of land, often more than a 100 hectares per farm. The intensive cultivation of cassava could decrease minimum farm sizes and reduce the rate of frontier movement.

In the North East, cassava development should be directed towards the creation of a dual market system. For the coming decade, farinha will stay the most important utilization of the crop and a strong effort should be made to maintain its critical role in the North East diet. Nevertheless, in an environment of continuing urbanization and wheat subsidies its market prospects are not expansive. Since the small farmer in this region is very dependent on cassava, the opening up of the animal feed market will be highly beneficial for his income earning capacity. Apart from the development and extension of cassava drying and industrial marketing systems, the success of this alternative market outlet will be greatly determined by the degree to which production costs are decreased. Since reduced production costs are also essential for the maintenance of farinha consumption, this implies that there is large common ground in the farinha and the animal feed strategy.

The South East of Brazil has the most complicated utilization pattern, with farinha, starch, fresh cassava and on-farm feeding existing simultaneously. The starch market appears to have good perspectives for income, market development and competitiveness reasons. Further development of it will depend on reducing production costs, basically through increasing the relatively low yield levels of the region.

In the South of the country, the dominate cassava market is for cassava as an on-farm animal feed. Enhancing cassava's role in this burgeoning market segment depends on a further decrease in the production costs. These are already on the

low side, but might be reduced by the introduction of improved genetic material. Increasing cassava's importance for on-farm feeding would increase protein availability in the urban and rural markets as well as farmer's incomes.

In the South fresh cassava consumption is higher than in any other region. The introduction of storage methods would allow fresh cassava consumption to stabilize itself or increase above present levels. This, in turn, improves its role as an income source for urban-oriented fresh vegetable producers.

It is clear from the analysis done in the previous chapters that cassava will have a prominent role in the agricultural sector of Brazil. The ability of cassava to substitute for feed grain imports, to supply calories to the poorest strata of society, to provide incomes and steady cash flows to small farmers with marginal land resources, and to provide semi-industrial employment in processing activities turn the crop in an efficient agricultural policy instrument. The present political situation, in which a newly established democratic government tries to direct its policies more to the welfare of the overall electorate, provides the best opportunity of the last thirty years for cassava to contribute to balanced economic development of this South American giant. Appropriate inclusion of cassava in its development plans will surely guarantee the consolidation of Brazil's first place in the world's cassava league.

References:

- Pachico, D. (1981). Technical change in agriculture and poor consumers: The distributional impact of improved cassava production technology in Brazil. Mimeograph, CIAT.
- Williamson-Gray. (1982). Food Consumption Parameters for Brazil and their Application to Food Policy, Research Report No. 32, IFPRI, Washington.
- World Bank (1979). A review of agricultural policies in Brazil, World Bank, Washington, report No. 3305-BR.

APPENDIX 1: PRICE AND INCOME ELASTICITIES FOR CASSAVA FLOUR AND FRESH CASSAVA

CASSAVA FLOUR:

CHARACTERISTICS:

- Zero-Order Regression Estimators Method (J. Kmenta, pp:341-45)
- Regressions for each individual region
- Double-Log function

ZERO-ORDER REGRESSION ESTIMATORS FOR CASSAVA FLOUR *

	NORTHEAST		SOUTH & SOUTHEAST	
	URBAN	RURAL	URBAN	RURAL
No. OBS	204	120	241	86
R-SQR	0.1444	0.1517	0.1005	0.0478
INTERCEPT	3.7858	17.1047	11.6075	23.8209
STD ERROR	6.3932	10.9232	8.1087	17.5737
INCOME	1.3270	1.2026	-0.2664	2.0162
STD ERROR	0.5244	1.5548	0.9044	2.1349
INCOME-SQR	-0.0911	-0.0661	-0.0022	-0.1422
STD ERROR	0.0364	0.1204	0.0555	0.1422
Pr. RICE	0.0086	1.1289	0.2351	0.9328
STD ERROR	0.2635	0.5727	0.4769	0.9807
Pr. WHEAT	0.1458	-0.6271	0.0047	0.3747
STD ERROR	0.3475	0.2585	0.2842	0.3925
Pr. FARINHA	-0.9294	-0.3428	-0.8329	-0.3728
STD ERROR	0.2088	0.2164	0.2388	0.5742

(*): LOG Q= Bo+LOG Inc+LOG SQR_InC+LOG PRice
+LOG PWheat+LOG PFari+ error

INCOME ELASTICITIES FOR CASSAVA FLOUR BY INCOME GROUP (1975)

	NORTHEAST	SOUTHEAST	SOUTH
	(URBAN AREAS)		
SALARY GROUP			
SC=<1/2	0.2260	-0.2941	-0.2945
1/2<SC=<1	0.0997	-0.2972	-0.2976
1<SC=<2	-0.0266	-0.3003	-0.3007
2<SC=<5	-0.1936	-0.3044	-0.3047

FRESH CASSAVA:

CHARACTERISTICS:

- Mean cells (for consumption and expenditure) as observations
- Dummy variables were used for rural/urban areas
- Double-Log function

PRICE AND INCOME ELASTICITIES FOR FRESH CASSAVA *

	FRESH CASSAVA			
	NORTHEAST		SOUTH & SE	
	URBAN	RURAL	URBAN	RURAL
INCOME ELASTICITIES (BY SALARY CLASS)				
SC=<1/2	2.7109	2.6529	2.6824	2.6228
1/2<SC=<1	2.5939	2.5293	2.5654	2.4991
1<SC=<2	2.4769	2.4056	2.4484	2.3755
2<SC=<5	2.3222	2.2421	2.2937	2.2120

PRICE ELASTICITIES

OWN PRICE	-1.8776	-1.8776	-1.8776	-1.8776
Pr. RICE	-1.8968	-1.8968	-1.8968	-1.8968
Pr. WHEAT	1.4937	1.4937	1.4937	1.4937
Pr. POTATOES	0.2442	0.2442	0.2442	0.2442

(*): MODEL: LOG Q= Bo+LOG Inc+LOG SQR_InC(1+dummy Rural)
+SUM (LOG Prices)

R-SQR=.6077 and No.OBS=153

WHERE PARAMETERS ESTIMATED WERE:

	INTERCEPT	CASSAVA	RICE	WHEAT	POTATOES
ESTIMATE	-18.8697	-1.8776	-1.8968	1.4937	0.2442
STD ERROR	14.0865	0.3857	0.4117	0.2871	0.2594

	INCOME	INCOM-SQR	RURAL(INC-SQR)
ESTIMATE	3.7308	-0.0844	-0.0048
STD ERROR	1.4465	0.0376	0.0005

APPENDIX 2A: NORTHEAST
LOCAL MAIZE PRODUCTION AND SUPPLY COSTS,
PER TON, NOMINAL PRICES, 1986.

	FACTOR COSTS			INPUT COSTS		TOTAL
	LABOR	LAND	CAPITAL	TRADE- ABLES	NON-TRADE- ABLES	
FARM LEVEL						
FIXED COSTS	18,5	444,4	101,4	18,0	3,2	585,4
VARIABLE COSTS	275,9		133,5	313,6	9,3	732,2
TOTAL COSTS	294,3	444,4	234,8	331,6	12,5	1317,7
PRICE	3.25Cr/H 600Cr/Ha		n.a.			
TRANSPORTATION						
FIXED COSTS	44,1		25,9	33,4		103,4
VARIABLE COSTS	12,1			83,4		95,5
TOTAL COSTS	56,3		25,9	116,7		198,9
TOTAL						
FIXED COSTS	62,6	444,4	127,3	51,4	3,2	688,9
VARIABLE COSTS	288,0		133,5	396,9	9,3	827,7
TOTAL COSTS	350,6	444,4	260,7	448,3	12,5	1516,6

APPENDIX 2B: NORTHEAST
LOCAL MAIZE PRODUCTION AND SUPPLY COSTS,
PER TON, SHADOW PRICES, 1986.

	FACTOR COSTS			INPUT COSTS		TOTAL
	LABOR	LAND	CAPITAL	TRADE- ABLES	NON-TRADE- ABLES	
FARM LEVEL						
FIXED COSTS	18,5	444,4	98,9	14,4	3,2	579,4
VARIABLE COSTS	275,9		120,1	256,9	9,3	662,2
TOTAL COSTS	294,3	444,4	219,0	271,3	12,5	1241,6
PRICE	3.25Cr/H 600Cr/Ha		n.a.			
TRANSPORTATION						
FIXED COSTS	44,1		20,7	26,7		91,6
VARIABLE COSTS	12,1			59,5		71,6
TOTAL COSTS	56,3		20,7	86,2		163,2
TOTAL						
FIXED COSTS	62,6	444,4	119,6	41,1	3,2	671,0
VARIABLE COSTS	288,0		120,1	316,4	9,3	733,8
TOTAL COSTS	350,6	444,4	239,7	357,5	12,5	1404,8

APPENDIX 2C: NORTHEAST
MAIZE SUPPLY COSTS FROM THE SOUTH
PER TON, NOMINAL PRICES, 1986.

	FACTOR COSTS			INPUT COSTS		TOTAL
	LABOR	LAND	CAPITAL	TRADE- ABLES	NON-TRADE- ABLES	
FARM LEVEL						
FIXED COSTS	27,5	220,0	27,5	56,6		331,6
VARIABLE COSTS	330,0		32,2	193,2		555,4
TOTAL COSTS	357,5	220,0	59,7	249,7		887,0
PRICE	6.25Cr/H 800Cr/Ha		n.a.			
TRANSPORTATION						
FIXED COSTS	107,5		133,7	163,4		404,6
VARIABLE COSTS	95,8			228,5		324,3
TOTAL COSTS	203,2		133,7	392,0		728,9
TOTAL						
FIXED COSTS	135,0	220,0	161,2	220,0		736,2
VARIABLE COSTS	425,8		32,2	421,7		879,7
TOTAL COSTS	560,8	220,0	193,5	641,7		1615,9

APPENDIX 2D: NORTHEAST
MAIZE SUPPLY COSTS FROM THE SOUTH
PER TON, SHADOW PRICES, 1986.

	FACTOR COSTS			INPUT COSTS		TOTAL
	LABOR	LAND	CAPITAL	TRADE- ABLES	NON-TRADE- ABLES	
FARM LEVEL						
FIXED COSTS	27,5	220,0	26,7	45,2		319,4
VARIABLE COSTS	330,0		31,3	175,0		536,3
TOTAL COSTS	357,5	220,0	57,9	220,3		855,8
PRICE	6.25Cr/H 800Cr/Ha		n.a.			
TRANSPORTATION						
FIXED COSTS	107,5		106,7	130,8		344,9
VARIABLE COSTS	95,8			171,0		266,8
TOTAL COSTS	203,2		106,7	301,8		611,7
TOTAL						
FIXED COSTS	135,0	220,0	133,3	176,0		664,3
VARIABLE COSTS	425,8		31,3	346,1		803,1
TOTAL COSTS	560,8	220,0	164,6	522,1		1467,5

APPENDIX 2E: NORTHEAST
MAIZE SUPPLY COSTS FROM GOIAS
PER TON, NOMINAL PRICES, 1986.

	FACTOR COSTS			INPUT COSTS		TOTAL
	LABOR	LAND	CAPITAL	TRADE-ABLES	NON-TRADE-ABLES	
FARM LEVEL						
FIXED COSTS	37,0	200,6	48,6	100,2		386,4
VARIABLE COSTS	150,2		40,2	663,1		853,5
TOTAL COSTS	187,3	200,6	88,8	763,3		1239,9
PRICE	n.a.	461Cr/Ha	n.a.			
TRANSPORTATION						
FIXED COSTS	173,5		156,9	192,8		523,2
VARIABLE COSTS	148,0			582,8		730,8
TOTAL COSTS	321,5		156,9	775,6		1254,0
TOTAL						
FIXED COSTS	210,5	200,6	205,5	293,0		909,5
VARIABLE COSTS	298,3		40,2	1245,9		1584,3
TOTAL COSTS	508,8	200,6	245,7	1538,8		2493,9

APPENDIX 2F: NORTHEAST
MAIZE SUPPLY COSTS FROM GOIAS
PER TON, SHADOW PRICES, 1986.

	FACTOR COSTS			INPUT COSTS		TOTAL
	LABOR	LAND	CAPITAL	TRADE-ABLES	NON-TRADE-ABLES	
FARM LEVEL						
FIXED COSTS	37,0	200,6	38,9	80,1		356,6
VARIABLE COSTS	150,2		35,2	564,1		749,5
TOTAL COSTS	187,3	200,6	74,0	644,2		1106,1
PRICE	6,25Cr/H	800Cr/Ha	n.a.			
TRANSPORTATION						
FIXED COSTS	173,5		130,3	154,2		458,0
VARIABLE COSTS	148,0			417,9		566,0
TOTAL COSTS	321,5		130,3	572,2		1024,0
TOTAL						
FIXED COSTS	210,5	200,6	169,2	234,4		814,6
VARIABLE COSTS	298,3		35,2	982,0		1315,5
TOTAL COSTS	508,8	200,6	204,4	1216,4		2130,1

APPENDIX 3: PRIVATE (A) AND DOMESTIC (B) COSTS OF PRODUCING
DRIED CASSAVA IN THE NORTHEAST OF BRAZIL, 1986

1 US-DOLLAR = 14.2 CRUZADOS

APPENDIX 3A: NORTHEAST
DRIED CASSAVA PRODUCTION, PROCESSING AND MARKETING COSTS,
PER TON, NOMINAL PRICES, 1986.

	FACTOR COSTS			INPUT COSTS		TOTAL
	LABOR	LAND	CAPITAL	TRADE- ABLES	NON-TRADE- ABLES	
FARM LEVEL						
FIXED COSTS	86,4	189,6	26,5	79,6		382,2
VARIABLE COSTS	538,3		63,1	7,0	76,2	684,5
TOTAL COSTS	624,6	189,6	89,6	86,6	76,2	1066,7
PRICE	3.25Cr/H 1000Cr/Ha		62			
PROCESSING						
FIXED COSTS	35,3	0,9	11,4	48,8		96,4
VARIABLE COSTS	70,3		6,2	15,5		92,0
TOTAL COSTS	105,6		17,6	64,3		188,4
TRANSPORTATION						
FIXED COSTS	44,0		26,0	34,0		104,0
VARIABLE COSTS	12,0			84,0		96,0
TOTAL COSTS	56,0		26,0	118,0		200,0
TOTAL						
FIXED COSTS	165,6	190,5	63,9	162,5		582,6
VARIABLE COSTS	620,6		69,3	106,5	76,2	872,5
TOTAL COSTS	786,2	190,5	133,2	269,0	76,2	1455,1

APPENDIX 3B: NORTHEAST
DRIED CASSAVA PRODUCTION, PROCESSING AND MARKETING COSTS,
PER TON, SHADOW PRICES, 1986.

	FACTOR COSTS			INPUT COSTS		TOTAL
	LABOR	LAND	CAPITAL	TRADE- ABLES	NON-TRADE- ABLES	
FARM LEVEL						
FIXED COSTS	86,4	189,6	21,2	59,7		357,0
VARIABLE COSTS	538,3		63,1	5,6	72,4	679,3
TOTAL COSTS	624,6	189,6	83,0	65,3	72,4	1036,3
PRICE	3.25Cr/H 1000Cr/Ha		62			
PROCESSING						
FIXED COSTS	35,3	0,9	10,7	46,2		93,0
VARIABLE COSTS	70,3		6,2	10,9		87,4
TOTAL COSTS	105,6		16,9	57,0		180,3
TRANSPORTATION						
FIXED COSTS	44,0		20,8	27,2		92,0
VARIABLE COSTS	12,0			58,8		70,8
TOTAL COSTS	56,0		20,8	86,0		162,8
TOTAL						
FIXED COSTS	165,6	190,5	52,7	133,1		542,0
VARIABLE COSTS	620,6		69,3	75,2	72,4	837,5
TOTAL COSTS	786,2	190,5	122,0	208,3	72,4	1379,4

APPENDIX 3C: NORTHEAST
DRIED CASSAVA PRODUCTION, PROCESSING AND MARKETING COSTS,
PER TON, NOMINAL PRICES, OPPORTUNITY COSTS FOR LABOR AND LAND 1986.

	FACTOR COSTS		INPUT COSTS			TOTAL
	LABOR	LAND	CAPITAL	TRADE- ABLES	NON-TRADE- ABLES	
FARM LEVEL						
FIXED COSTS	95,5		26,5	79,6		201,7
VARIABLE COSTS	595,2		63,1	7,0	76,2	741,5
TOTAL COSTS	690,7	0,0	89,6	86,6	76,2	943,1
PRICE	3.6Cr/H	0Cr/Ha	6%			
PROCESSING						
FIXED COSTS	26,9	0,9	11,4	48,8		88,0
VARIABLE COSTS	53,6		6,2	15,5		75,3
TOTAL COSTS	80,5		17,6	64,3		163,2
TRANSPORTATION						
FIXED COSTS	44,0		26,0	34,0		104,0
VARIABLE COSTS	12,0			84,0		96,0
TOTAL COSTS	56,0		26,0	118,0		200,0
TOTAL						
FIXED COSTS	166,4	0,9	63,9	162,5		393,7
VARIABLE COSTS	660,8		69,3	106,5	76,2	912,7
TOTAL COSTS	827,1	0,9	133,2	269,0	76,2	1306,4

APPENDIX 3D: NORTHEAST
DRIED CASSAVA PRODUCTION, PROCESSING AND MARKETING COSTS,
PER TON, SHADOW PRICES, OPPORTUNITY COSTS FOR LABOR AND LAND, 1986.

	FACTOR COSTS		INPUT COSTS			TOTAL
	LABOR	LAND	CAPITAL	TRADE- ABLES	NON-TRADE- ABLES	
FARM LEVEL						
FIXED COSTS	95,5		21,2	59,7		176,5
VARIABLE COSTS	595,2		63,1	5,6	72,4	736,3
TOTAL COSTS	690,7	0,0	83,0	65,3	72,4	912,7
PRICE	3.6Cr/H	0Cr/Ha	6%			
PROCESSING						
FIXED COSTS	26,9	0,9	10,7	46,2		84,6
VARIABLE COSTS	53,6		6,2	10,9		70,6
TOTAL COSTS	80,5		16,9	57,0		155,2
TRANSPORTATION						
FIXED COSTS	44,0		20,8	27,2		92,0
VARIABLE COSTS	12,0			58,8		70,8
TOTAL COSTS	56,0		20,8	86,0		162,8
TOTAL						
FIXED COSTS	166,4	0,9	52,7	133,1		353,1
VARIABLE COSTS	660,8		69,3	75,2	72,4	877,7
TOTAL COSTS	827,1	0,9	122,0	208,3	72,4	1230,7

- COLOMBIA: POTENTIAL DEMAND FOR CASSAVA -

I.	Macroeconomic Policy and Agriculture	1
A.	Economic Policy Context	1
B.	The Policy Environment	1
II.	Agricultural Policies	3
A.	Specific Agricultural Policies	5
1.	Price and Commercialization Policies	5
2.	Credit Policies	5
3.	Research and Extension Policies	6
B.	Concluding Comments	7 -
III.	Status Quo of Cassava in Colombia: Supply and and Distribution	8
A.	Present Status	8
1.	Fresh Cassava Consumption	9
2.	Econometric Analysis	10
a)	Cross Sectional Data	10
b)	Time Series Data	10
3.	Other Uses	10
B.	Potential Demand for Cassava	11
1.	Carbohydrate Foods	11
2.	Meat Consumption	12
C.	Projected Demand for Cassava	13
1.	Basic Assumptions	14
2.	Fresh Cassava	14
3.	Dry Cassava	15
IV.	Concluding Comments	16

COLOMBIA: POTENTIAL DEMAND FOR CASSAVA.-

- Macroeconomic Policy and Agriculture.

This section focuses on the various economic aspects that have influenced resource allocation in Colombia, particularly between the agricultural sector and the rest of the economy (in a macro context) and within the agricultural sector during the past two decades. The analysis of the set of policies applied should contribute to the understanding of the role that the food and fiber sector have played in the development of the country, how that role has evolved and more importantly how it is likely to evolve in a near future. Once we reach a comprehension of this participation, we will focus on the role of cassava and its products and their potential demand in the near future. This latter part will be done by focusing on the consumption of carbohydrates by humans, where cassava plays a basic role, and on the market for meats where cassava can be incorporated as a source of energy in feed rations.

A.- Economic Policy Context.- The Colombian economy has experienced a stable and rapid growth since the mid-1950s. This growth has had as its platform, the performance of the agricultural sector which contributes nearly a quarter of GDP (table 1), close to two-thirds of export earnings (mainly coffee) and one-third of total employment in the economy. Agriculture's share in GDP is twice as high in Colombia as it is for Latin America and the Caribbean (LAC) region as a whole. Its per capita GDP for 1,985 was US\$1,243 (15th among 25 LAC countries, table 2).

Real GDP grew at an annual rate of 4.2% in the period 1964-67, 6.4% in the period 1967-74 and at 5.3% in the period 1975-80, to slow down in the eighties to 1.9% in 1981-85. This growth was accompanied by rates of growth of 2.8%, 4.7%, 4.1% and 1.4% for the agricultural sector, respectively. Population growth was around 2.1% in the period 1965-85, and has slowed down quite fast to about 1.5% per year. Urban population accounts for 70% of total. International reserves are US\$3 billion at the end of 1,986. For this same year, exports are calculated to reach US\$4.5 billion and imports around US\$4 billion.

B.- The Policy Environment.- In broad terms, Colombia has striven for food self-sufficiency. Out of 12 items that supply about two-thirds of the protein and calorie requirements of the population, 99% was produced internally (García, Revista SAC, Marzo 1983). The country went from an import substituting to an export promotion policy in 1,967 (Decreto 444). A continuous devaluation policy (crawling peg) was adopted, improving the terms of trade by reducing the overvaluation of the Peso. Total exports grew at an annual rate of 4.6% in the period 1970-75, 12.0% in 1976-80 and -5.4% in 1981-83 while agricultural exports did so at 2.0%, 13.8% and 2.8% in those years.

Colombia also has one of the lowest per capita public external debt of Latin America (US\$485 table 2A) as of 1,986, although debt service is

close to one fourth of foreign exchange earnings. The exchange rate policy of the past two decades was fundamental to the low foreign debt contracted by the country. The fixed rates constituted an incentive to obtain external financing.

Industrial protection has been a policy objective too. It happens at the expense of agriculture. Garcia showed that 90% of an import tariff is transferred as a tax to primary exports. The price of importable inputs (fertilizer, machinery,...) increases. Producers of other import-competing and exportable goods are penalized (Valdes). In the presence of import restraints, the price of importables is driven up with the consequent drop in demand (i.e., the feed industry would have grown faster in the absence of these policies). Nontradeables (like cassava) are at a disadvantage with importables (wheat, sorghum) in the competition for resources.

Starting in 1978 the country witnessed a decrease in its rate of growth, a phenomenon observed in most Latin American countries. The sharp increase in 1980 of the international interest rates and the world recession that brought reductions in the prices of primary exports merged in Colombia with another adverse element: the coffee boom of the late seventies.

"In the late 1970's, a coffee boom set in motion a rapid growth in the money supply and inflation, despite the stabilization efforts of the Colombian authorities. The deceleration in the depreciation in the crawling peg exchange rate led to an appreciation of the Real Exchange Rate, which reduced incentives to produce noncoffee agricultural tradeables. This deceleration ... contributed to inflation. Although some attempt was made to increase agricultural incentives... these policies were directed only at import-competing cereals and ignored a vast agricultural sector." (Valdes, p.173).

Real GDP grew at an annual rate of 2.4% in 1978-85, agricultural GDP grew at 1.8% while population (total and urban) increased at 1.9% and 3.3% respectively. The level of international reserves dropped from over US\$5 billion in 1980 to US\$2 billion in 1985. The current account deficits that started in 1981 were no longer compensated by credits. The fiscal deficit as percent of GDP went from 2.0% in 1980 to 4.2 in 1984. Inflation continued around 20.0% as the fiscal deficit was financed with monetary expansion. The real rate of exchange based on 1975=100 went to 70 in 1980 and to 80 in 1984 (SAC Jun. 1985). The policy of mild liberalization pursued in the past 10 years came to an end in 1982 when the tariff levels were increased and the number of agriculture and food categories with most items being restricted went from four to seventeen (out of twenty-one). Nominal rates of protection for cereals increased significantly presumably due to tighter import restrictions (Thobany in WB4981-CO).

Compensatory policies to domestic agricultural production, like subsidized credit, became quite expensive as those resources came from Open Market Operations at substantially higher costs (Montes, SAC,

March 1, 1983). Other price inputs (wages, fertilizer, etc.) increased faster than output prices (table 3). Apparently, agricultural non-wage value added has been declining and rural wages have increased even in real terms, to become the highest of South America by January 1, 1985 (at US\$4.00 per day plus a mark-up of about 40% for social benefits). At the same time migration was high and unemployment grew to over 14.5% in 1,985.

After a devaluation of 50% in 1,985, the country achieved balance in the current account and the perspectives for higher revenues from primary exports (coffee, coal and oil) are quite good; economic recovery has begun already. Population growth is expected to remain at 1.5% per year, while real GDP should increase at an annual 3.0%. Beginning 1,986 about 70% of the import positions were transferred to the free import list, including farm inputs.

In summary, the macroeconomic and trade policies of Colombia led to an appreciation of the real exchange rate that switched consumption to tradeables (grains and cereals) and away from nontradeables (like cassava). Agricultural production is locked in a high cost scheme that makes it non competitive at world prices. Compensatory policies adopted to stimulate agricultural production were mostly directed at importables (grains and barley and wheat) while ignoring a vast agricultural sector; besides, these policies have lost effectiveness in recent years. Investment in the sector has been reduced. Lower unit costs are needed to increase production at profitable levels. The easing of import restraints (particularly for inputs) as well as the improvement in terms of trade are seen as favorable developments in that sense. But yield improvements are a must in the mid-term.

II.- Agricultural Policies.

Presently, about 55% of gross agricultural output comes from crop activities and 45% from livestock (table 4). The latter increased its share from 37% in 1,970 due mainly to the strong dynamism of poultry and pork production (table 2 p. 27 WB/RF, v 2). The agroindustrial sectors are growing more rapidly than primary agriculture (Machado). The ratio of value-added in agro-processing to value added in crops and livestock increased from 54% in 1,970 to 70% in 1,983.

In the period 1,953-67, when significant distortions existed between domestic and international prices, per capita GDP grew at 1.2% and per capita food production did so at -0.4%. The rate of migration was 5.3%. In addition to this, the threat of agrarian reform and land pressures meant that the number of units operated by renters and sharecroppers fell from 282,347 in 1,960 to 166,539 in 1,970 (BID, ESP in LA, 1,986, p. 124). When prices became more in alignment with the international market (in 1,967-78), per capita GDP grew at 3.2% and per capita food production increased at 0.7%. Rural migration increased at a rate of 3.5% between 1,967 and 1,978. The ratio of urban to rural wages had been falling steadily since the 1,950's until 1,970 when it recovered rapidly. "Distortions in relative commodity prices

induced by commercial and exchange rate policies caused changes in factor prices that contributed to the massive outflow... This was an opportunity to become more land intensive..." (Garcia, p. 57).

In 1,978 started the slow down of the economy, linked to the world recession and the after shock of the coffee bonanza. In per capita terms, GDP and agricultural GDP increased at 0.7% and -0.4% per year in 1978-85, respectively. Area harvested decreased from 4.3 million hectares in 1,978 to 3.8 million hectares in 1,984 (table 5). Terms of trade for agriculture, as measured by the ratio of sectoral deflators for value added were much lower in 1,983 than in 1,970, but they increase until 1,977 and decreased thereafter (table 6).

Decomposing the growth rate for the 17 major crops in 1970-84, 0.9% came from cultivated area while 2.5% came from higher yields and changes in crop composition. In that lapse, the annual growth in area cultivated for tree crops reached 1.8%, for cane crops (sugar and panela) by 0.9% and for grains (mostly sorghum) by 1.2%.

Between 1,977 and 1,983, the wholesale price index for food increased annually 4.8 percentage points more rapidly than the farm gate price index (table 6A). This suggests that reducing the costs of marketing is a key target in improving food supplies, since they have grown much faster than production costs.

After 1,978, use of fertilizer has also decreased (Balcazar en Machado, SAC sep. '85), real prices of inputs increased, the overvaluation of the Peso became more marked and rural instability kept high, meaning that Colombian agriculture is now less competitive. Illegal, parallel and black markets continued to be important, with the subsequent impact on resource cost and allocation, particularly on wages and land. Contraband from Venezuela and Ecuador (after sharp devaluations in both countries) is at its highest, affecting agricultural supply but stimulating demand. FENALCO estimates that contraband of agricultural products and inputs (wheat and corn flour, poultry meat, eggs, sorghum and feed, urea, machinery, vegetable oils, etc.) amounted to over US\$1 billion in 1,986. Food imports amount to about US\$400 million or 7.5% of total imports (USDA Attache Report).

The slow down of agriculture is the result of a number of biases that affect agricultural production. At first glance, there has been a policy of protection in effect for most agricultural products in Colombia. The internal price of most products has been higher than the international price; nominal protection indexes are positive (Garcia). However, to be able to conclude that there was effective protection, one has to bring the overvaluation of the Peso into the picture. If the nominal protection is higher than the overvaluation, the product was protected. In this sense, only products like powder milk, oils and fats, and wheat would be truly importables, since they have been effectively protected even after making the adjustment for the overvaluation. Rice, coffee and cotton, for example, have been discriminated against in this sense for the past two decades (Garcia).

A.- Specific agricultural policies have been designed as second best or compensatory policies. The targets have been the commercial products, as we will see now.

1.- Price and Commercialization Policies. Four types of direct Government intervention prevail in Colombia: (i) output price supports; (ii) price fixing in output and input markets; (iii) agricultural export subsidies and taxes; and (iv) agricultural trade restrictions including import tariffs and import/export licensing.

INA, created in 1,944 and later restructured under IDEMA, has been the organism responsible for administering the food policies of support and warranty prices, stocks, imports and exports, conduct studies and extend credit (Silva, in Machado, 1,986). Support prices have been implemented for commercial products (rice, cotton, wheat, sorghum, corn, soybeans, sesame and barley) and for beans, the only traditional crop included in the list. These prices have served mainly as a price floor although IDEMA's participation in direct purchases has been modest, except for wheat with purchases of 38% of production in 1,970-82, sorghum (14.5% in 1,982) and some rice. Generally, support prices have been similar to market prices, and have grown in real terms in the past quinquennium; sorghum and corn had real price increases of about 12% in 1,979-82.

To moderate price increases to the urban consumers, IDEMA has occasionally imported food to sell it at controlled prices (wheat flour, beans, milk, oils and fats, rice and sugar) (Rivas et al).

In addition to support prices, there are negotiated prices (between the Government and the private sector: coffee, sugar, milk), and minimum prices (cocoa, sisal as well as fertilizers and pesticides).

Closely related to this topic, is the program to build wholesale markets (Centrales de Abastos). There are 3 working (Bogota, Medellin, Cali) and there are 4 more being built: Barranquilla, Bucaramanga, Pereira y Cucuta. These facilities improve marketing, specially of perishables like cassava, where losses constitute an economic problem of considerable magnitudes.

The main instruments of intervention in agricultural foreign trade have been tariffs, taxes, subsidies and quantitative restrictions on imports and exports. Rice export permits have been granted only if domestic surpluses are anticipated. Taxes apply mostly to coffee exports. Protection to importables is reflected in the nominal protection rates measured by a comparison of the domestic and international prices (table 7).

2.- Credit Policies.- The three main policy tools used are forced financing (Law 5), low and controlled interest rates and directed credit allocations. Two major institutions responsible for administer-

ing agricultural credit are the FFAP and Caja Agraria. Most of the credit supplied by FFAP is directed to commercial agriculture (90% of the funds rediscounted by FFAP have had that destination) (Martinez, in Rivas et al., p.23). Of Colombia's 1.2 million farmers, 75% are classified as small farmers. 80% of Caja Agraria credit goes to about 440,000 small farmers (half of the target group).

The compensatory power of credit has lost a great deal of its force. Although agricultural credit grew at a rate of 2.2% in real terms in 1,970-1,984 (table 8), its share in total credit went from 31% to 15% and its participation in the GDP went from 27.9% to 20.8% in that lapse. Interest rates charged by FFAP and Caja were subsidized and negative in real terms until 1,982. With the liberalization of the financial market, rates went up significantly (Table 9).

More importantly, in real terms, agricultural credit decreased in 1980-83. Furthermore, while 52% of the sectoral credit in 1,970 came from primary money emissions, in 1,981 only 6.5% did so (Montes) explaining the reduction in subsidy as part of the monetary policy agreed with the international financing institutions. Caja had a crisis in 1,984 when its real disbursements were 15.3% lower than the previous year. This is especially significant for small farmers, an important segment of the Caja's clients.

In terms of the type of commodities being financed, FFAP has concentrated its lending on a few commercial crops: irrigated rice, sorghum, soybeans and cotton. For these crops, FFAP provides 90% or more of total credit granted. On the other hand, Caja has financed a wide spectrum of commodities that are characteristic of small farming systems (table 10). Producer associations and banks provide most of the credit for coffee and rice, the major credit recipients.

The crop receiving proportionately most credit in 1974-83 is sorghum, with a ratio of credit to value of production of 0.43; then come sesame (an exportable with 0.33), rice (0.33), cotton (0.38), wheat (0.19) and corn (0.19). For cassava and yams the ratio is only 0.06.

The three importables in that list (sorghum, corn and wheat) are among the crops that have been more strongly protected; the ranking according to Nominal Protection Coefficient (NPC) is barley, corn, sorghum, wheat and soybeans (table 7). The NPC has to be adjusted by the overvaluation of the currency, input taxes and credit subsidies. Janssen calculated for the case of sorghum that at 30% overvaluation the protection was no longer in effect.

3.- Research and Extension Policies.- Government expenditures in agriculture, although have been quite profitable (60% rate of return in 1,950-80) and have had a significant contribution to output growth (30% in that period according to Elias) have decreased in per hectare terms between 1,970 and 1,980. Out of ten countries studied by Elias, Colombia had the highest Government expenditure in agriculture per hectare of cropland in 1,970 (US\$217) while in 1,980 (with US\$195) was

below the group average (the countries are Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru, Venezuela and the U.S.). This shows that agriculture has been historically important to the country, but has been less so in the past decade.

ICA, created in 1,962 has as primary mission to generate and transfer improved production technologies. To complement this effort with other production support services for the small farmers, such as credit, social services and marketing, the DRI program was created in 1,970, with emphasis being focused increasingly on food production targets. Potential beneficiaries are 82,958 farmers or 8% of all tenants with less than 20 has. in Colombia.

Within agriculture, it seems that research and extension have had a strong bias in favor of commercial agriculture, supporting the emphasis of the overall agricultural policies enforced.

B.- Concluding comments. The modernization of agriculture made it more dependent on imported inputs, whose trade has been restricted. Agricultural credit reduced its participation in total credit from 31% in 1,970 to 17% in 1,981, input costs (labor, machinery, fertilizer, seed, etc.) grew faster than output prices (cost-price squeeze), public investment in research went from 0.46% in 1,972 to 0.20% in 1,982, public expenditures in agriculture went from 25% in 1,970 to 7.6% in 1,981 (Prieto et al. Econ. Col. #184-185, 1986). However, government expenditures in agriculture are quite in line with those of other Latin American countries: in 1,980, and per hectare of cropland they amounted to US\$195 while per worker employed in agriculture they were US\$377. (See Elias, IFPRI Report #50, 1,985).

From the viewpoint of Colombian producers, output prices are too low and yet they are not competitive in the world market (with the exception of coffee, bananas and a few minor export crops). The consensus is that the resulting biases from the other policies have been so strong that agriculture (mainly coffee) has had to pay more than half of the industrialization costs (Valdes) with a loss of competitiveness that made necessary the implementation of compensatory policies. These were directed to tradeables (importables like sorghum, corn, wheat and soybeans) and exportables like rice, i.e., to commercial agriculture. While in the end, there was no effective protection for these crops, nontradeables (like cassava) were left even in a worse relative condition, for they had to support the effects of protectionism through higher input prices and worse terms of trade for agriculture, but there were no compensating policies to stimulate their production. The incentives and subsidies have been such that they have created a flow from the small to the large farmer, from nontradeables (traditional) to tradeables (commercial) and from agriculture to the other sectors.

This partially explains the little dynamism in food production (reflected in higher food imports) since the traditional sector is the

one that supplies more than half of the energy and protein needs of the population (table 11). For example, cassava, beans, plantains, potatoes, beef and milk are mostly produced by this type of growers.

II.- Status quo of Cassava in Colombia: Supply and Distribution.-

A.- Present Status.- The root is produced mostly by small farmers, frequently being part of a complex system of production. Intercropping with corn, yams, beans and/or cowpeas is frequently found among small producers. In the Atlantic Coast, the largest producing region in the country, 35% of total incomes received from agricultural activities are generated by cassava. Within the small farm system, 40% of all cultivated land is estimated to be in a cassava cropping system. "Most often it is cultivated with maize and yam (40% of the time) or with maize alone (25% of the time). At present cassava monoculture is a second best alternative, which is practiced only if intercropping is not possible because of credit shortages" (Janssen). Production in the Eastern region also follows similar patterns.

Relatively large commercial plantations (over 20 has.) are more frequently found in the coffee region (Caicedonia, Pereira, Palestina), where land and labor are expensive. Intensive technologies are applied and yields are much higher (around 20 tons/ha.). The variety "Chiroza" is the one preferred in that region.

There is a wide geographic divergence of consumption according to the different regions of the country but cassava is a major staple throughout the country. This is a reflexion of cassava's ample adaptation to the heterogeneous geography of Colombia. The crop is found in the coffee region up to 2,000 mts. a.s.l., in the lowlands of the Coast, in the acid savannas of Meta, in the humid tropical forests of the Pacific region; in summary, it is found everywhere. This versatility is a great asset of the crop.

Production figures closely resemble consumption. By 1,985, the major cassava producer is the Atlantic region, with 35.3% of the total, followed by the Eastern (29.4%) and the Central (24.4%) regions (table 12). The same pattern is shown in regional per capita consumption figures (table 13).

Time series data published by MAG has unexplainable abrupt breaks, specially from 1,969 to 1,970. The data are unreliable due to the various difficulties involved in collecting cassava production figures (many small dispersed producers, variable production cycle with different planting alternatives, multiple end uses, etc.) (Lynam, Pachico).

MAG data shows a decrease in cassava production at an annual rate of -1.3% for 1970-85. Consequently, per capita consumption for the period dropped at an annual -3.3%. Yields do not show any significant trend (at about 9 tons per ha.). The lower output is explained by reductions in area planted. The reduction in supply has been accompanied by a

steady demand, as reflected by real consumer price increases of 1.7% per year(table 14).

1.- Fresh Cassava Consumption.- Cassava is an important food staple in Colombia, particularly to consumers in the northern part of the country (Atlantic Coast and Oriental Region), those in the rural sector and in the poorest segments of the population. This is not to say that the root is not consumed by upper income groups. Actually, the highest per capita consumption is found among the richest people of the rural sector in the Atlantic region (82 kgs. per capita in 1,981, see tables 13 and 15). Within that particular group, cassava makes up for 3.0% of food expenditures and for 9.9% of the calories intake. At lower income levels, although physical ingesta is lower, it takes a larger proportion of incomes and contributes to caloric intake in a more significant way. Again in the rural Atlantic region, the lowest income groups spend about 7.0% of their food expenditures in cassava and it represents about 15% of their energy intake (table 16).

The root is consumed mostly in fresh form, and 62.2% of it is own-consumption. Cassava consumption at by producers in the Atlantic Coast is of 170 kgs. per capita per year (Janssen). This shows the fundamental role of cassava both as a staple food and as an income generator for small producers. The percentage of the crop that is actually consumed by the farmer decreases with income level. At the lowest quintile, 68.2% of consumption takes place in the own farm. Average per capita consumption, according to the DANE/DRI 1,981 survey, is 25.5 kilos at the national level, 41.1 kilos at the rural level and 17.2 kilos at the urban level.

In the Atlantic rural zone, at the lowest income levels, cassava is the second source of calories (with 15%) after rice (25%) but prior to plantains (12%), sugar (11%) and vegetable oils (10%). In the rural Eastern zone and again at low income levels, cassava comes third as an energy source after potatoes and corn. Consumption of cassava in Bogota is not high in per capita terms (7.2 kgs.), but it represents a sizable yearly amount anyway (about 50,000 tons). It comes from Meta, Cundinamarca and the Central coffee region (northern Valle, Risaralda, Caldas).

The abrupt and varied geography of the country, although allows production of different regionally adapted varieties, constitutes an obstacle to commercialization. The high perishability and high water contents of the root as well as the cost of assembling a product produced on a relatively small scale become an important cost mark up (Lynam and Pachico). Sharply segregated markets exist with ample price differentials. This is reflected by the inability of cassava from the Coast (the region with the lowest price) of entering the Bogota market (with the highest consumer price) although margins would compensate by far the cost of transportation. The sizable risk involved in entering the market constitutes an effective barrier to entry; as a result the already established intermediaries have good bargaining power at both ends of the chain (producer and retail).

2.-Econometric analysis of Demand.- Both time series and cross sectional household budget data were analyzed in an effort to determine the value of the main parameters influencing cassava consumption in Colombia.

a.- Cross Sectional Data.- The advantage of using these data lies in the possibility of exploring consumption patterns at a microeconomic level: by regions, by income levels, by type of household, etc. An important issue at hand was to establish both the price and income responsiveness of cassava consumption at varying income levels.

Data from the household expenditure survey of 1,981 conducted by DANE/DRI reveals that cassava consumption is quite responsive to income changes, especially at the lower quintiles, where it is elastic (1.47 and 1.23, see table 17); more importantly, it is not only responsive to income changes (as could be inferred by simple inspection of the data presented in table 13) but it is also quite responsive to changes in retail prices (table 17). The average price elasticity for the country was calculated at -0.88. The value of this parameter is similar to those calculated by Janssen in the Atlantic Coast (Janssen, p.161). Average income elasticity is 0.20.

b.- Time series data.- Most analyses of this type of data have concluded that cassava is an inferior commodity, i.e., that income elasticity for consumption is negative. This result is obtained by regressing per capita consumption (which usually decreases over time) against continuously rising per capita incomes. The result clearly contrasts with measurements arising from cross sectional data. Why should the two measurements be so different?

Our hypothesis is that a primary element causing the decrease in per capita cassava consumption is urbanization. This element goes beyond price increases. It has important repercussions on market structure (decreases competitiveness) and therefore on volumes traded. Consequently, a model of demand for cassava with independent variables being prices (own price, wheat, rice), per capita real incomes and number of people in the urban zones of the country was estimated.

The results show that cassava is quite responsive to its own price changes (elasticity of 0.43), to prices of other competing goods (rice has an elasticity of substitution of 0.09), to per capita real income (elasticity of 2.51) and to the proxy for urbanization (with an elasticity of -1.55, see table 18). In other words, the major force behind the decrease in cassava consumption in 1970-85, was urbanization (through higher prices and restricted market access) and to a lesser extent the lower price of rice. Income growth, on the other hand, was a positive force in making the reduction less marked.

3.- Other uses. Presently, there are close to 40 small floor drying plants of cassava that being used in animal feed rations. These are located in the Northern Coast and in 1,986 produced about 5,000 tons.

The profitability of the plants, together with the advantageous position that the associations offer to members and neighbours in terms of employment, reduction of marketing risks and earnings make them an attractive proposition, mainly to small farmers in those areas where there are marked dry seasons (4 months or more) (Varias citas aqui.....). The major advantage lies in the concept of market integration, where members are able to capture margins at several places in the marketing chain.

"In terms of other uses there is a large scale starch plant in the north Coast, which in 1,970 manufactured a little over 1,000 tons and two zones of small-scale sour starch producers in Cauca and Antioquia departments, producing an estimated 4,600 tons, most of which went into the bakery industry" (Lynam and Pachico, p.60). Converted to fresh cassava, starch production represents about 15,000 tons in Cauca (almost all of the production of that department). For the country, the amount is probably around 40,000 tons (2.3% of production).

"The 1,970 census estimated on-farm feeding at 50.4 thousand tons (Ministerio de Agricultura, 1979)..... This represents about 8% of energy requirements of the non-technified swine population outside the Andean zone. This is considered a reasonable figure given the results of the survey" (Lynam and Pachico, p.61).

B.- Potential Demand for Cassava.- Cassava has the potential of playing a fundamental role in supplying food requirements to the population of Colombia in the near future. It can contribute directly to alleviate the energy deficits of the population and, indirectly, the proteic deficits too, by entering in the least-cost feed rations as a complement to other energy sources that are currently deficitaries in their production (mostly sorghum and corn). Briefly, we will examine the carbohydrate and animal meat markets, to establish the potential demand for cassava in the near future.

1.- Carbohydrate Foods.- Cassava, along with rice, corn wheat, potatoes and plantains represent a major component of Colombian diets (table 11). They account for 45% of total calorie intake in 1,981. Food expenditures represent about half of total consumption expenditures and the six products mentioned here represented about 25.6% of food expenditures (table 19).

In 1960-84, rice had the largest rate of per capita consumption increase (at 4.1% per year) closely followed by potatoes (3.6%) (table 14). The widespread adoption of improved varieties, now accounting for close to 100% of the area, became quite significant after 1,967, when ICA and CIAT introduced IR8 and other dwarf varieties developed for use in irrigated tropical areas. Rice is today the second largest recipient of subsidized agricultural credit in Colombia (table).

Potato production began to show a marked increase in 1,972. Adoption of new technologies, continuous growth in the availability of subsidized credit, increased use of fertilizer, and increased price in-

stability at the farm level played important roles in stimulating higher yields and production. In 1,977, 61% of potato output came from labor intensive production (72% of the area) while the remaining 39% came from mechanized production (Sanint, ERS).

Plantains have shown some reduction in yields, due to the presence of new diseases (sigatoka). About 33 percent of the area is monoculture and the rest is intercropped, mostly as a shadow to traditional coffee plantations.

Wheat yields exhibited a moderate growth, but production decreased by an annual 5.6% in 1960-84, despite the protection resulting from the import substituting policy. Per capita consumption of wheat increased at a rate of 1.6% per year in 1960-84 spurred by growing import volumes.

Corn for human consumption also showed decreases equal to the annual growth of the population. Feed use of corn has increased moderately (table 20). Corn production is dualistic; about half of the area planted to corn is found in subsistence units, usually associated with other crops (cassava, yams, beans, etc.). Its yields have remained virtually unchanged in 1,960-84 although in 1974-84 they showed an increase of 1.2% per year while area planted has decreased at 1% per year in 1960-84.

Again, this is another protected crop that has been unable to respond to the stimulus in the form of subsidized credit, research and extension. Corn has one of the highest ratios of credit to value of production among all crops (0.19). However, imports have been frequently needed to supply domestic needs throughout the past 10 years.

Real retail prices reflect the impressive gains in rice yields over the past twentyfive years. They fell at an annual rate of -3.4% in 1960-84. Wheat flour prices also fell considerably, reflecting IDEMA's policy of supplying this product at low prices to the urban consumer by means of imports.

Cassava prices increased at 1.7% and even more relevant is the fact that there was a drastic increase in its relative price with respect to wheat and rice. The cross price elasticity of cassava consumption with respect to the price of rice reflects the negative impact on consumption of this root resulting from the lower rice prices.

2.-Meat Consumption. Beef is the dominant meat in colombian diets with 27 kgs. per capita per year, followed by poultry with 5.5kgs. and pork with 5.0 kgs. The most dynamic of the three is the poultry industry; its most rapid growth occurred in 1,970-78 with a 16% rate of increase. The recession also affected this industry in 1,979-85. Poultry consumption was 1.33 kgs. in 1,970. Per capita egg consumption went from 51.3 units in 1,970 to 129,2 units in 1,984.

beef supply has grown at rates similar to the population and therefore no significant trend in its per capita consumption was observed. Per capita consumption of pork grew at an annual 1.4% in 1960-84.

The dynamism of poultry production stems from the rapid adoption of new technologies that made possible drastic price cuts in the past 15 years. The ratio of feed to meat went from 3.3 in the sixties to 2.1 in the eighties (Rivas et al.). An important element was the availability of subsidized credit which grew at 13.6% per year in 1974-83. Another key element was the joint development of the feed and oil agroindustries, even in the face of the difficulties found in the supplies of sorghum and soy cake (Machado).

Yet, because feed represents between 60% to 70% of the total costs in the poultry and egg industry, and feed is heavily dependent on grain and oilseed production (commercial agriculture), which have been protected or at least compensated more than other crops, the industry has benefitted from the prevailing policies. That is, the poultry industry is linked to both agroindustry and commercial agriculture, where the policy incentives have been located and are likely to continue to be so.

In 1965-67 beef accounted for 82% of meat consumption, pork for 12% and poultry for 6%, while in 1982-84 beef's share was reduced to 72%, and pork and poultry went up to 14% each, revealing an important growth in poultry contribution to meat consumption linked to cheaper relative prices.

The feed agroindustry is dominated by three companies that control 60% of the market. 75% of feed goes to poultry, and the other 25% goes to pork, dairy, and others (Machado).

Relations among the oil and cake producers, feed manufacturers and sorghum producers have been difficult, due to Government intervention, mostly through import licence approvals and support prices for grains. Feed availability is a bottleneck to expansion of the poultry industry. The policy environment has not favored use of sorghum, as it was explained earlier. This is an importable whose production has not shown important yield advances and whose imports have been restrained. Local sorghum has expanded mainly its area with insignificant reductions in unit costs. Since it makes up for almost two-thirds of feed input requirements, it is imperative to reduce this cost by means of (i) yield increases and/or (ii) a cheaper substitute. Dry cassava has good potential to meet the latter requisite (Gomez et al, otros).

.- Projected Demand for Cassava.- The notorious slow down of Colombian food production, plus the fact that its agriculture is locked in a high-cost scheme and that target crops selected to activate agricultural production have not responded adequately to the compensatory efforts implemented, indicates that the actual food deficits are likely to worsen into the near future, unless important changes are incorporated in the food and fiber system.

1.- Basic Assumptions. Using the model estimated from time series data, we can project cassava consumption needs into the future. From the basic model:

Per Capita consumption = Function (Prices, Income, Urbanization)
one can assume changes in the independent variables, and calculate the new levels implicit in the dependent variable. We have assumed for Colombia a rather conservative scenario in which per capita real income grows at an annual rate of 1.0% in 1985-2000, population grows at 1.5% per year and the real price of cassava and the one for poultry meat decrease both at -1.0% per year while other retail prices remain constant in real terms.

2.- Fresh Cassava.- Prospects for carbohydrate production are not bright should the trends observed in the eighties continue. Only potato output has shown some growth in these years. Rice productivity and supply have been stagnant for the past 6 years, and its real price has increased; wheat imports have been growing fast while its production remains stagnant. This trends imply an improvement in demand for cassava in the mid-term range.

If we assume that current marketing and production practices prevail, cassava production will not be able to meet the expected increases in demand, and further increases in cassava's real retail price would result. However, there is reason to believe that the new storage technology for fresh cassava will have a favorable impact both in demand and in quantities traded, especially in the urban markets.

Important price fluctuations at the farm level can be observed throughout the country: \$8 to \$10/kg in the Atlantic Coast, \$12 to \$15/kg. in Santander (Eastern region), \$18 to \$25/kg. in the coffee region (chiroza variety). These differences are magnified at the consumer level: \$20/kg. in Barranquilla (Atlantic region), \$25/kg. in Bucaramanga (Santander, Eastern region), and \$100/kg. in Bogota.

Adding to this the fact that wholesale prices of agricultural goods have been growing faster than producer prices in Colombia, it is quite clear that a technology expressly directed at lowering marketing costs, like the storage of fresh cassava in plastic bags, can bring important benefits to both producers and consumers nationwide.

It has been calculated that cassava from the Atlantic region can be sold in Bogota at about \$40/kg. with this technology. Corabastos (the Central wholesale market) presently buys at \$60 to \$70/kg., i.e., 50% higher than what would be possible with the adoption of the new proposed storage technology. A reduction of this magnitude in the price of cassava implies a 44% increase in per capita consumption (elasticity times price decrease or $-0.88 \times -50\%$). For the case of Bogota, an increase of volumes traded of 29% and a reduction in waste of about 15% (from 30% today to 15% expected) are calculated.

The most relevant point here is that consumers will pay less while

producers will receive more (Janssen and Wheatley) by means of a significant reduction in waste and marketing costs, as well as the emergence of stronger markets. These results are the consequence of lowering of geographic barriers to entry due to lower perishability and therefore, of increasing access from further production points. Finally, combined demand and supply effects are achieved, resulting in motivation for adoption of better production and marketing technologies.

Therefore, the assumption of a reduction in the retail price of cassava rests initially on the implementation of the new storage technology. In such a case the rate of reduction in price could be much higher than the one proposed for this exercise. An additional assumption for projections is that with this technology, commercialization losses of cassava will be reduced from an estimated present level of 25% to 15% in the fresh market. If there is a parallel development of the drying industry, losses will be reduced to 5% since an additional 10% which is cassava not suitable for the fresh market due to quality problems (small size, or broken), and that is currently left on the field, could be utilized by this industry. Therefore, the final effect on additional production requirements will be 20% less due to a better usage of the crop.

Taking the initial level of per capita consumption implied by MAG series (44.5 kgs.) consumption by the year 2,000 will be 41.5 kgs. due to the negative impact that urbanization has on cassava consumption. Total consumption will go from 1,683 tons to 1,731 tons. Additional land of 7,153 thousand hectares will be required and 1,717 new jobs will be generated each year (table 21).

3.- Dry Cassava.- The major requirements to the development of a this type of industry are present now. It is likely that if some compensatory measures are directed to this activity (similar to the ones applied to grains, for example), the industry will flourish quickly. We have established that dried cassava is:

- i) Profitable at the farm level under the present price and cost structure of the country. If the policy bias is ameliorated, the conditions will be even more favorable.
- ii) Profitable at the feed plant level: dry cassava enters in the least-cost feed formulations at around 90% of the price of sorghum (the main substitute).
- iii) It is attractive to the end user, since feed quality remains virtually unchanged.

To estimate feed needs by the year 2,000, both poultry and pork production are projected, using time series data. For poultry, it is further assumed that the same ratio of meat to egg production is maintained into the future. There also be a 10% share for other uses (dairy, mainly). This is reasonable in view of past trends. Demand estimates for poultry consumption indicate that it is quite responsive to price and income changes (elasticities of -0.46 and 0.88, respectively, see table 22). Also, the decreasing price of poultry has

had a negative impact on beef consumption (cross price elasticity of 0.66).

Under the same assumptions about poultry price, income and population rates of growth in 1,984-2,000, per capita poultry consumption will go from 5.0 to 6.9 kgs. and pork consumption will increase from 5.3 kgs. to 5.9 kgs. These are the two main users of feed.

In terms of feed requirements, total needs will go from 1,579 thousand tons. in 1,984 to 2,786 thousand tons. in 2,000, mostly due to poultry feed increases. Sorghum (and yellow corn) needs will be 1,811 thousand tons.

Sorghum production will keep a strong annual growth of 4.0% per year. Even so, imports will go from 42 thousand tons in 1,984 to 633 thousand tons in 2,000. With a 10% use of dry cassava (279 thousand tons) in the feed formulations, imports will be lower at 354, thousand tons, a savings of US\$28 million.

An additional 523 thousand tons of fresh cassava will be required, which amount to about 52,338 has. (at 10 tons/ha.) and 16,043 new annual jobs will be generated.

Crop losses will be substantially reduced also. Given the previous assumption that there will be a reduction of 10% in fresh cassava marketed and other 10% of the root that is presently unacceptable for fresh consumption and will serve as input for drying, we have an annual reduction in crop losses of US\$57 million.

In summary, if both markets are added up (fresh and dry), annual requirements of cassava will be 595 thousand tons, 59,490 has. will be cultivated and 17,760 additional workers will be employed.

IV.- Concluding Comments.

Colombia is heavily dependent in its agricultural sector as the major source of growth, employment and foreign exchange. Sustained growth was possible in the sixties and specially in the seventies, until 1,978 when the country was affected by the regional recession. From that year there has been a reduction in area harvested of 500,000 has. International reserves went from US\$5 billion in 1,978 to US\$2 billion in 1,984 to rebound at US\$3 billion in 1,986. Agricultural GDP decreased in per capita terms in 1,978-85.

Unemployment has worsened, malnutrition is increasing and food production has not responded adequately to the growing needs. Import restraints contributed to keep food import at stable levels.

The country is locked to a high cost structure resulting from the predominance of coffee and the adverse effects of the illegal crops in the sector. Overvaluation of the Peso was drastically reduced in 1,985 when a 50% rate of continuous devaluation was implemented, but most

crops are still not competitive by international standards.

Compensatory policies have been in effect to reduce the adverse effects of macroeconomic and trade policies on the sector. They have taken the form of price and credit policies. Commercial agriculture has been the target; importables like grains, oilseeds, wheat and milk; and exportables like rice and sesame. Rice, however, has had trade restrictions that amount to negative protection.

These policies have ignored a vast agricultural sector, which has been relatively discriminated against by other sectors of the economy and by the chosen products within the sector. Special emphasis has to be placed on nontradeables, like cassava which has been unable to compete for resources with other more favored crops.

Cassava consumption has been adversely affected by the rapid urbanization of the country. It means higher price for the consumer as well as market access restrictions. In 1970-84 its consumption was the one that decreased the most among the group of carbohydrates. Yields are still low (9 tons/ha. is the national average). The crop is still fundamental for small producers, for poor consumers, and those living in the rural areas. Own-consumption represents a significant share (40.3% at national level).

Income elasticity is quite high at low income levels (close to 1.5). Price response has also been important: elasticities of -0.88 from cross sectional data (long term elasticity) and -0.43 from time series (shorter-term elasticity) were estimated. There has been substitution away from rice in the period analyzed (1,970-1,984).

In the meat sector, there has been a strong growth of the poultry and egg industry at the expense of beef consumption. Relative price of chicken has decreased considerably with respect to the ones of pork and beef. Income elasticity and price elasticities for poultry were found to be significant and important in determining the rapid growth of its consumption. This growth brought high demand pressures to the feed industry and therefore to commercial feed inputs like sorghum and oilseed cakes. These crops have been unable to meet the challenge, constituting a bottleneck for a more rapid development of the industry, in the face of the import restraint policies enforced.

There is a high and growing demand for fresh cassava but unless marketing constraints are reduced (by implementing the new storage technology developed by ITRC-CIAT) real retail prices will keep rising, marketing margins will remain high and market access will be quite restricted. Consequently, there will be little or no incentives to adopt technologies more demanding of input usage. It is imperative to make improvements in the commercialization of cassava to meet the growing needs of the population.

Dry cassava production is just starting in commercial scales and it is proving that is quite profitable to the farmers involved as well as to

feed manufactures and end users. In terms of Domestic Resource Cost, it is more effective than growing sorghum. Therefore, dry cassava has an important role to play in filling the gap left by sorghum production in filling the needs of one of the most dynamic industries in the country, namely the feed industry.

Given its ability to grow on marginal lands, its intensive use of labor and its vastly unexploited yield potential, cassava appears as a strong candidate to contribute in a more relevant manner to supply the important calorie and protein deficits of the Colombian population, to generate employment and increase income levels among small farmers and to save foreign exchange by substituting for imported foods.

Table 1. Colombia, Gross Domestic Product - Total and
Agriculture in Constant Prices 1970 Pesos
(Millions)

	Total GDP	Agriculture GDP	Percent Agric
1960	71,902	24,305	33.8%
1965	90,351	27,834	30.8%
1970	119,797	34,245	28.6%
1975	163,399	44,066	27.0%
1976	170,227	44,905	26.4%
1977	178,326	46,097	25.8%
1978	194,818	50,575	26.0%
1979	203,664	52,618	25.8%
1980	211,930	53,954	25.5%
1981	217,228	55,580	25.6%
1982	219,183	54,622	24.9%
1983	221,375	55,606	25.1%
1984	228,459	56,940	24.9%
1985	234,956	58,591	24.9%
	GDP	Agric.	
1960-67	4.6%	2.9%	
1967-78	6.0%	4.5%	
1978-85	2.4%	1.8%	
1981-85	2.0%	1.5%	

Source: IDB Economic and Social Progress in Latin America
Several Issues.

Country	Total (Millions 1984 dollars)						Per Capita (1984 dollars)			
	1960	1970	1980	1983	1984	1985*	1960	1970	1980	1985*
Argentina	35,236.5	52,874.0	67,144.3	61,543.9	63,023.8	60,250.8	1,710	2,227	2,387	1,971
Bahamas	n.a.	n.a.	1,667.5	1,726.3	1,778.3	1,840.5	n.a.	n.a.	7,444	7,275
Barbados	379.5	692.9	816.1	758.4	775.0	793.7	1,650	2,911	3,103	2,865
Bolivia	2,611.9	4,245.9	6,594.9	5,692.0	5,518.2	5,402.6	793	989	1,178	840
Brazil	59,345.8	100,712.5	228,798.6	220,137.4	230,043.5	249,137.2	821	1,086	1,923	1,852
Chile	11,572.9	17,510.7	22,480.6	20,237.4	21,520.6	21,947.3	1,524	1,870	2,025	1,817
Colombia	10,466.2	17,431.9	29,805.6	31,069.2	32,063.5	32,961.3	673	834	1,195	1,243
Costa Rica	1,373.3	2,445.6	4,233.3	3,946.0	4,240.8	4,309.5	1,040	1,417	1,910	1,708
Dominican Republic	2,213.6	3,631.9	7,099.7	7,808.0	7,837.1	7,665.0	643	847	1,280	1,225
Ecuador	2,774.0	4,461.8	10,469.5	10,675.7	11,108.4	12,462.1	626	749	1,300	1,222
El Salvador	1,750.2	3,029.9	4,163.7	3,633.4	3,687.2	3,746.2	658	856	923	771
Guatemala	3,474.2	5,936.1	10,287.4	9,733.8	9,795.3	9,685.7	886	1,140	1,488	1,216
Guyana	416.5	583.1	689.3	566.7	588.0	593.9	690	814	876	720
Haiti	1,047.5	1,134.9	1,801.6	1,697.8	1,727.8	1,757.5	293	268	359	320
Honduras	1,158.4	1,885.2	3,001.4	2,968.0	3,050.9	3,142.4	583	696	810	719
Jamaica	2,506.7	4,222.6	3,868.9	4,097.8	4,081.4	3,918.1	1,490	2,259	1,814	1,701
Mexico	44,116.4	86,895.0	164,658.3	167,459.1	173,614.9	178,288.9	1,190	1,698	2,402	2,248
Nicaragua	1,307.0	2,548.3	2,638.7	2,880.1	2,839.4	2,764.2	870	1,294	954	845
Panama	1,162.8	2,496.7	4,268.3	4,708.1	4,687.6	4,841.4	953	1,617	2,183	2,218
Paraguay	n.a.	2,528.2	5,861.6	6,120.5	6,308.7	6,559.1	n.a.	1,104	1,850	1,777
Peru	9,117.3	15,203.6	21,351.1	19,540.5	20,465.4	20,772.4	878	1,134	1,232	1,055
Suriname	n.a.	n.a.	1,125.3	1,104.2	1,102.7	1,046.2	n.a.	n.a.	2,900	2,642
Trinidad and Tobago	1,436.3	2,165.9	3,462.1	3,578.5	3,342.4	3,359.1	1,706	2,268	3,165	2,837
Uruguay	4,827.6	5,629.1	7,577.7	6,649.4	6,429.1	6,472.7	1,902	2,080	2,651	2,208
Venezuela	16,936.2	30,492.8	45,682.6	43,279.7	42,693.8	42,527.6	2,127	2,735	3,041	2,451
Latin America	215,230.8	368,758.6	659,548.1	641,611.9	662,323.8	685,245.4	1,040	1,380	1,933	1,782

* Preliminary estimate.

n.a. Not available.

Source: IDB, Economic and Social Progress in Latin America, 1986.

Table 2A. Statistical Profile *

Area (Km ²)	1,138,336				
Population: Total 1984 (69.9 % urban)	26,526,000				
Annual growth rate 1970-85	1.6				
Birth rate (1981).....	28.9				
Mortality per 100 inhabitants (1982).....	5.8				
Infant mortality per 100 live births (1981).....	60.9				
Life expectancy at birth (1981).....	62.1				
Percentage of literacy (1981).....	81.0				
Labor force by sector (1980)	(Percentages)				
Agriculture	34.3				
Manufacturing	17.7				
Commerce & Finance	15.9				
Services	19.4				
Others	12.7				
	1981	1982	1983	1984	1985**
Real Production					
					(Growth rates)
Total GDP (market prices)	2.3	0.9	1.0	3.2	2.8
Agricultural sector	3.2	-1.9	1.8	2.4	2.9
Mining sector	5.4	1.8	13.2	14.3	24.6
Manufacturing sector	-2.6	-1.4	0.5	6.7	2.5
Construction sector	7.1	4.0	5.1	4.7	3.7
Public Sector					(Percentages of GDP)
Current revenues	19.6	19.6	19.5	20.5	20.3
Current expenditures	17.6	17.9	17.4	17.9	17.5
Current savings	2.0	1.7	2.1	2.6	5.8
Capital expenditures	7.9	8.2	9.7	10.1	10.0
Deficit or surplus	-5.9	-6.5	-7.6	-7.5	-3.7
Domestic financing	3.1	4.1	5.0	5.0	0.2
Money, prices and salaries					(Growth rates)
Domestic credit	51.0	123.3	66.2	82.9	18.0
Public sector	-5.3	299.4	212.4	236.3	9.1
Private sector	30.6	22.7	42.1	27.3	26.6
Money supply (M1)	21.2	25.4	25.6	23.2	27.5
Consumer prices (annual average)	27.5	24.5	19.8	16.1	24.0
Real wages	2.0	5.0	6.1	6.0	-3.0
Exchange rate					(Annual Average)
Official rate (national currency units/dollar)	54.49	64.09	78.85	100.82	144.68
Real effective exchange rate					
(Index 1980 = 100).....	92.8	87.7	88.3	96.7	115.1
Terms of trade					
(Index 1980 = 100)	77.5	88.3	90.4	93.6	92.1
Balance of payments					(Millions of dollars)
Current account balance	-1,894.0	-2,729.0	-2,747.0	-2,248.0	-1,670.0
Merchandise balance	-1,572.0	-2,114.0	-1,494.0	-566.0	-356.0
Merchandise exports (FOB)	3,158.0	2,933.0	2,970.0	3,414.0	3,671.0
Merchandise imports (FOB)	4,730.0	5,047.0	4,464.0	3,980.0	4,027.0
Net Services	-631.0	2,245.0	-1,673.0	-1,887.0	-1,778.0
Transfers.....	242.0	169.0	164.0	205.0	464.0
Capital account (net)	2,040.0	2,231.0	1,436.0	837.0	1,990.0
Change in net reserves (- = increase)	-242.0	701.0	1,723.0	1,261.0	-284.0
Total external debt					(Millions of dollars)
Disbursed debt	8,069.0	9,555.0	10,574.0	11,667.0	12,867.0
Debt service actually paid	1,116.0	1,418.0	1,573.0	1,644.0	1,882.0
Interest payments/export of					(Percentages)
goods and NFS	21.3	27.2	26.3	27.7	25.4

* Where necessary, the items of information presented in this table are defined in the list of sources.

** Preliminary estimate.

n.a. Not available.

Source: IDB Economic and Social Progress in L.A., 1986.

Table 3. Index of prices for main inputs and implicit prices for agriculture, Colombia.

Years	Wages	Machinery	Diesel	Fertilizer	Seeds	Insecticides	Prices
1970	100	100	100	100	100	100	100
1975	278	312	201	484	240	270	235
1978	651	477	660	669	418	395	442
1979	789	648	898	732	489	444	512
1980	1,079	816	1,130	943	585	586	599
1981	1,341	1,103	1,528	1,305	702	747	728
1982	1,654	1,164	1,662	1,364	770	813	908

	<u>Annual Rates of Change</u>	
	<u>1973-81</u>	<u>1977-81</u>
Prices Received by Farmers (Crops)	20.0%	15.2%
Prices Received by Farmers (Livestock)	18.8%	20.2%
Fertilizer Prices	30.7%	24.1%
Pesticides Prices	n.a.	21.3%
Seed Prices	n.a.	24.8%

Source: FAO Production Yearbook, 1983, p.312

Table 4. Gross Value of Production by Subsector, 1970-83
(Col\$ million)

Year	Crops			Livestock			Total
	Non-Coffee	Coffee	Subtotal	Beef and Milk	Other	Subtotal	
1970	18,082 (0.485)	5,348 (0.143)	23,430 (0.628)	11,313 (0.303)	2,578 (0.069)	13,891	37,321
1971	20,072 (0.482)	4,745 (0.114)	24,817 (0.596)	13,727 (0.329)	3,133 (0.075)	16,860 (0.404)	41,677
1972	24,775 (0.477)	6,286 (0.121)	31,061 (0.598)	17,176 (0.331)	3,671 (0.071)	20,847 (0.402)	51,908
1973	30,720 (0.454)	8,090 (0.120)	38,810 (0.574)	23,632 (0.349)	5,196 (0.077)	28,828 (0.426)	67,638
1974	43,598 (0.472)	9,656 (0.105)	53,254 (0.577)	32,110 (0.347)	6,981 (0.076)	39,091 (0.423)	92,345
1975	53,932 (0.473)	12,123 (0.106)	66,055 (0.579)	38,324 (0.336)	9,612 (0.085)	47,936 (0.421)	113,991
1976	65,181 (0.448)	20,752 (0.143)	85,933 (0.591)	47,481 (0.326)	12,037 (0.083)	59,518 (0.409)	145,451
1977	86,214 (0.425)	37,681 (0.186)	123,895 (0.611)	60,705 (0.300)	13,074 (0.089)	73,779 (0.389)	197,674
1978	96,693 (0.404)	43,045 (0.180)	139,738 (0.584)	76,755 (0.321)	22,685 (0.095)	99,440 (0.416)	239,178
1979	120,141 (0.407)	49,997 (0.170)	170,138 (0.577)	96,496 (0.327)	28,207 (0.096)	124,703 (0.423)	294,841
1980	152,080 (0.420)	57,716 (0.160)	209,796 (0.580)	117,072 (0.324)	34,543 (0.096)	151,615 (0.420)	361,411
1981	189,107 (0.418)	69,938 (0.154)	259,045 (0.572)	149,618 (0.330)	44,057 (0.098)	193,675 (0.428)	452,720
1982	227,967 (0.411)	77,801 (0.140)	305,768 (0.551)	187,272 (0.338)	61,671 (0.111)	248,943 (0.449)	554,711
1983 (p)	265,426 (0.398)	101,841 (0.154)	367,267 (0.551)	225,177 (0.338)	74,380 (0.111)	299,557 (0.449)	666,824

Sources: DANE, Cuentas Nacionales de Colombia; and Departamento Nacional de Planeación Unidad de Estudios Agrarios, Division de Comercializacion, Estadisticas, documento de trabajo, 5 junio de 1984.

Table 5. Area Harvested by Groups of Principal Crops, ^{a/} 1950-84
(thousand hectares)

Year	Grains	Oil Crops	Coffee	Cotton and Tobacco	Cane Crops	Beans and Tubers	Tree Crops	Total
1950	973.9	14.0	656.0	55.6	158.0	329.4	191.4	2378.3
1951	1134.2	14.0	660.0	59.7	168.0	378.5	194.7	2414.4
1952	1233.0	17.0	675.0	75.2	170.0	392.5	196.0	2758.7
1953	1090.0	17.0	831.0	85.1	166.5	373.5	197.4	2761.4
1954	1103.0	18.2	872.5	101.3	175.2	413.5	220.4	2904.1
1955	1243.5	21.1	816.2	101.5	178.1	395.7	234.0	2990.1
1956	1238.2	23.9	725.5	89.4	180.3	396.7	239.2	2893.0
1957	1040.0	22.0	790.4	85.1	177.6	402.2	247.5	2764.8
1958	1092.7	48.0	832.5	99.5	182.5	366.0	248.6	2869.8
1959	1153.0	41.0	858.7	153.5	181.8	349.5	259.9	2997.4
1960	1176.0	42.3	892.5	166.2	196.0	320.0	267.1	3060.1
1961	1159.1	48.7	831.5	165.8	199.2	302.5	271.4	2978.2
1962	1178.8	58.4	824.1	196.1	199.0	368.4	272.2	3097.0
1963	1119.2	74.5	810.0	164.2	207.6	356.4	282.6	3014.5
1964	1256.1	95.8	813.1	171.7	210.4	338.8	291.8	3177.7
1965	1439.8	117.7	812.0	159.7	209.0	354.9	265.9	3359.0
1966	1390.8	127.6	811.4	191.9	214.6	343.4	321.0	3400.7
1967	1249.7	110.2	810.6	195.5	223.7	363.4	325.0	3279.1
1968	1249.3	110.4	816.3	219.7	229.5	379.1	326.0	3330.3
1969	1112.5	129.9	816.0	260.0	235.8	381.8	325.8	3261.8
1970	1068.8	106.7	835.0	289.3	247.0	404.0	415.8	3366.6
1971	1102.9	115.9	836.0	242.0	247.0	405.9	423.0	3372.7
1972	1090.9	112.2	840.0	268.6	260.9	425.4	427.4	3425.4
1973	1115.6	107.5	1055.5	277.0	272.6	435.4	432.5	3695.9
1974	1180.0	104.7	1055.3	283.9	272.0	432.8	438.4	3767.1
1975	1184.9	145.1	1055.3	314.8	249.2	487.4	447.7	3884.4
1976	1237.5	89.7	1183.5	315.3	254.5	449.3	455.0	3984.8
1977	1174.5	97.8	1183.5	410.5	255.4	455.5	489.1	4066.3
1978	1399.9	118.0	1183.5	357.6	284.4	465.0	532.9	4341.3
1979	1383.5	122.3	1183.5	217.1	285.7	484.9	546.5	4223.5
1980	1336.5	126.9	1183.5	245.4	292.2	465.1	570.4	4220.0
1981	1361.0	88.5	1009.0	251.2	279.1	484.8	575.4	4048.0
1982	1453.4	93.3	1009.0	130.1	264.9	448.3	500.2	3899.2
1983	1314.6	103.9	1009.0	106.5	271.5	452.4	524.2	3782.1
1984	1255.0	97.2	1009.0	168.1	279.6	453.3	531.0	3793.2
Growth rates (%):								
1950-84	0.7	5.9	1.3	3.3	1.7	1.0	3.0	1.4
1960-84	0.3	3.5	0.5	0.0	1.5	1.5	2.9	0.9
1970-84	1.2	-0.7	1.4	-3.8	0.9	0.8	1.8	0.9
1950-60	1.9	11.7	3.1	11.6	2.2	-0.3	3.4	2.6
1960-70	-1.0	9.7	-0.7	5.7	2.3	2.4	4.5	1.0
1970-80	2.3	1.7	3.5	-1.6	1.7	1.4	3.2	2.3
1980-84	-1.6	-6.4	-3.9	-9.0	-1.1	-0.6	-1.8	-2.6

a/ Definitions: Grains - corn, rice, sorghum, barley, wheat
Oil Crops - sesame, soybeans, oil palm
Cane Crops - sugar cane - panela cane
Beans and Tubers - beans, potatoes, cassava
Tree crops - plantain, export bananas, domestic bananas, cacao.

Source: DNP-UEA.

Table 6. Measures of the Internal Terms of Trade for Agriculture, 1970-83

Year	Ratio of Sectoral Value Added Deflators (agriculture to non-agriculture)	Wholesale Price Ratio: Agriculture to All Consumer Goods	Ratio of Agricultural Producer Price to:	
			Consumer Price Index	Wholesale Index for Consumer Goods
1970	0.966	0.885	0.846	1.056
1971	0.955	0.872	0.856	1.018
1972	0.991	0.863	0.879	0.994
1973	1.051	0.925	0.939	1.036
1974	1.067	0.983	0.938	1.009
1975	1.000	1.000	1.000	1.000
1976	1.006	1.021	1.046	1.035
1977	1.099	1.022	1.103	1.039
1978	0.978	1.055	0.905	0.855
1979	0.896	1.033	0.886	0.802
1980	0.806	0.975	0.871	0.765
1981	0.788	0.933	0.841	0.731
1982	0.786	0.952	0.850	0.693
1983	0.775	0.954	0.868	0.684
Rates of change (%)				
1970-75	0.69	2.47	3.40	-1.08
1975-80	-4.22	-0.51	-2.72	-5.22
1980-83	-1.30	-0.72	-0.11	-2.21

Source: World Bank, Rural Financial Markets Sector Study.

Table 7: Nominal Rates of Protection by Crop, 1970-83.

	1970-74	1975-79	1980-83	1983
<u>I. Importables</u>				
Wheat	122.2	138.5	154.2	158.9
Sorghum	115.6	133.5	172.0	161.0
Corn	123.6	151.8	206.2	184.4
Soybeans	88.1	100.8	140.6	146.2
Barley	148.7	142.9	171.9	200.3
<u>II. Exportables</u>				
Coffee	47.0	46.2	44.6	48.6
Tobacco	49.7	53.4	60.8	52.1
Cacao	83.0	54.4	60.8	79.4
Exp. bananas	37.4	34.0	33.4	32.3
Sugar	61.4	81.1	111.5	156.7
Cotton	59.1	73.2	87.0	85.9
Rice	n.a.	104.6	129.7	150.7

Source: DNP-UEA-DC, Estadísticas - Division de Comercializacion, Bogota, 5 junio 1984.

Table 8. Colombia. Rural Financial Markets Sector Study. Total Rural and Agricultural New Loans and Outstanding Portfolio at Constant Prices ^{a/}, 1974-83.
(Col\$ million 1975)

Year	New Loans						Outstanding Portfolio					
	Total Loans	Index	Rural ^{b/} Loans	Index	Agricultural Loans	Index	Total Portfolio	Index	Rural ^{b/} Portfolio	Index	Agricultural Portfolio	Index
1974	51,392	120.2	17,971	120.1	12,148	104.1	70,623	93.7	20,548	104.0	16,778	100.9
1975	42,757	100.0	14,965	100.0	11,672	100.0	75,345	100.0	19,756	100.0	16,629	100.0
1976	88,937	208.0	22,673	151.5	17,069	146.2	89,725	119.1	19,745	99.9	17,129	103.0
1977	113,994	266.6	24,623	164.5	19,936	170.8	98,136	130.3	23,509	119.0	21,048	126.6
1978	131,747	308.1	27,262	182.2	21,155	181.3	111,277	147.7	23,580	119.4	20,184	121.4
1979	133,614	312.5	27,349	182.8	22,048	188.9	103,762	137.7	22,197	112.4	19,313	116.1
1980	192,053	449.2	27,009	180.5	22,167	189.9	123,963	164.5	23,749	120.2	21,163	127.3
1981	134,213	313.9	22,693	151.6	17,457	149.6	141,371	187.6	23,860	120.8	21,015	126.4
1982	126,282	295.4	24,872	166.2	18,684	160.1	141,121	187.3	25,080	127.0	21,860	131.5
1983	128,883	301.4	25,702	171.8	20,375	174.6	159,404	211.6	26,166	132.5	23,143	139.2

Annual Growth Rates

1974-78	26.5%	11.0%	15.0%	12.0%	3.5%	4.7%
1978-83	-0.3%	-1.0%	-0.8%	7.4%	2.1%	2.8%
1974-83	10.8%	4.1%	5.9%	9.5%	2.7%	3.6%

^{a/} All figures deflated by GDP deflator (see Table 1.2).

^{b/} Includes agriculture, marketing and agro-industries.

Source: World Bank.

Table 9. Evolution of the real rates of interest for the FFAP and the Caja Agraria, Colombia.

Years	FFAP	Caja Agraria		
		Small	Medium	Large
1979	-4.8	-8.4	-4.2	-2.1
1980	-0.5	-6.2	-2.0	0.1
1981	-0.9	-4.3	1.0	8.0
1982	1.1	-2.6	2.9	10.3
1983	7.5	3.5	9.4	17.2
1984	6.0	2.0	7.9	15.6

Source: Alvaro Bálcazar, Observaciones sobre el manejo de las tasas de interes y la distribucion del credito agropecuario.

Table 10. Cumulative Agricultural Credit in Relation to Areas Harvested and Production, by Crop, 1974-83

Crops	(1) <u>b/</u> Credit Extended	(2) <u>b/</u> Area Harvested	(3) <u>b/</u> Value of Production	Ratios	
	Col\$ million	('000 ha)	Col\$ million	(1)/(2)	(1)/(3)
Rice	54,374.5	3,944.1	162,662.9	13.8	0.33
Potatoes	16,817.7	1,372.3	137,196.7	12.3	0.12
Corn	17,226.8	6,069.1	92,241.2	2.8	0.19
Plantain	6,176.4	3,773.1	116,919.6	1.6	0.05
Panela cane	6,883.7	1,858.6	123,404.2	3.7	0.06
Cassava & yams	7,394.3	2,142.7	115,000.0	3.5	0.06
Fruit <u>a/</u>	2,969.3	268.6	n.a.	11.1	n.a.
Sugar cane	4,106.4	943.7	74,609.9	4.4	0.06
Sorghum	19,490.5	2,094.6	44,905.9	9.3	0.43
Soya	5,416.2	615.3	21,829.8	8.8	0.25
Sesame	924.2	251.3	2,724.9	3.7	0.34
Cacao	1,250.6	640.0	28,550.8	2.0	0.04
Oil palm	2,359.8	223.9	23,080.5	10.5	0.10
Wheat	1,217.3	375.3	6,330.8	3.2	0.19
Cotton	21,411.6	2,330.2	77,182.2	9.2	0.28
Coffee	63,202.5	12,064.1	436,708.9	5.2	0.14
Sisal	204.9	272.4	n.a.	0.8	n.a.
Tobacco	1,714.1	302.2	16,034.8	5.7	0.11
Total	233,140.8	39,541.5	1,364,383.1	5.9	0.17
Average:					
Short-cycle					
Crops <u>c/</u>	16,030.34	2,132.77	68,134.30	7.52	0.24
Perennials	9,874.19	2,260.73	117,044.10	4.37	0.08
Overall	12,952.27	2,196.75	90,958.87	6.20	0.14

a/ Annual yields for fruit are the total production over all species divided by the total area harvested in all species.

b/ Cumulative values over 1974-83, inclusive.

c/ Rice, potatoes, corn, cassava & yams, sorghum, soya, sesame, wheat, and cotton.

Source: World Bank, Rural Financial Markets Sector Study.

Table 11. Percent contribution of calories for the different food items in rural and urban areas by groups of income. Colombia. 1981.

Type of food	Area Urbana					Area Rural					
	Quintil					Quintil					
	I	II	III	IV	V	I	II	II	IV	V	
Meats	3.55	4.91	5.77	6.10	6.98	3.13	4.22	5.05	4.98	4.94	5.35
Beef	3.15	4.49	5.15	5.16	5.34	2.76	3.58	4.36	4.08	4.24	4.50
Pork	0.07	0.11	0.20	0.39	0.67	0.08	0.16	0.24	0.29	0.20	0.30
Poultry		0.08	0.11	0.21	0.32	0.59	0.03	0.16	0.18	0.23	0.18
Fish	0.25	0.21	0.21	0.23	0.39	0.26	0.32	0.26	0.39	0.32	0.28
Dairy and Eggs	4.78	6.15	7.22	8.04	9.17	4.91	6.15	6.59	5.97	7.57	7.09
Dairy	3.99	4.96	5.98	6.69	7.63	4.23	5.30	5.75	5.05	6.61	5.95
Eggs	0.79	1.19	1.24	1.34	1.54	0.68	0.84	0.84	0.92	0.96	1.14
Cereals	34.62	31.12	29.79	29.38	27.95	30.39	29.37	27.79	27.50	28.16	29.43
Rice	18.78	16.69	15.21	14.29	12.78	15.53	14.25	13.36	13.61	12.26	14.49
Maize	7.48	6.17	4.80	4.63	3.66	9.58	9.48	8.41	6.78	9.62	6.27
Wheat	7.54	7.32	8.58	9.08	9.28	4.43	4.96	5.26	6.06	6.02	7.41
Other	0.82	0.93	1.20	1.38	2.23	0.85	0.69	0.76	1.05	0.26	1.26
Roots and Tuber	10.47	10.20	9.35	8.27	6.64	18.35	15.88	14.27	13.19	12.18	10.91
Cassava	2.82	2.58	2.50	2.32	1.54	9.23	8.04	7.26	5.69	6.02	4.13
Potatoe	7.53	7.39	6.54	5.71	4.83	8.68	7.60	6.78	7.29	5.80	6.52
Other	0.12	0.23	0.30	0.23	0.27	0.44	0.23	0.22	0.21	0.36	0.26
Pulses	2.58	2.50	2.54	2.29	2.18	1.89	2.05	2.12	2.26	2.25	2.27
Beans	2.40	2.35	2.32	2.0	1.91	1.52	1.90	1.93	2.04	2.14	2.04
Other	0.18	0.16	0.21	0.20	0.27	0.37	0.15	0.19	0.21	0.11	0.22
Other food items	44.00	45.12	45.34	45.93	47.08	41.34	42.33	44.19	46.10	44.90	44.95
T O T A L	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Sanint et al.

Table 12. Area, Production and yields of cassava in Colombia, 1984.

Dept. or Territory	Area	Product.	Yields	%
Santander	30,000	285,000	9,500	16.9%
Antioquia	22,100	174,590	7,900	10.4%
Cordoba	12,000	120,000	10,000	7.1%
Bolivar	15,000	120,000	8,000	7.1%
Atlantico	13,000	104,000	8,000	6.2%
Cundinamarca	9,000	90,000	10,000	5.3%
Sucre	8,000	80,000	10,000	4.8%
Magdalena	10,000	80,000	8,000	4.8%
Quindio	5,000	75,000	15,000	4.5%
Caqueta	8,000	64,000	8,000	3.8%
Tolima	7,000	63,000	9,000	3.7%
Huila	6,000	60,000	10,000	3.6%
Meta	7,000	56,000	8,000	3.3%
Cesar	5,500	55,000	10,000	3.3%
Guajira	3,500	35,000	10,000	2.1%
Norte de Santander	5,000	35,000	7,000	2.1%
Arauca	4,000	32,000	8,000	1.9%
Valle	2,600	31,200	12,000	1.9%
Boyaca	4,000	29,200	7,300	1.7
Putumayo	5,000	25,000	5,000	1.5%
Caldas	1,500	22,500	15,000	1.3%
Nariño	1,300	16,000	12,308	1.0%
Cauca	1,600	16,000	10,000	1.0%
Risaralda	1,000	15,000	15,000	0.9%
Choco	0	0	0	0.0%
T o t a l :	187,100	1,683,490	8,998	
By Regions			Total %	
Atlantic Region	67,000	594,000	8,866	35.3%
Eastern Region	55,000	495,200	9,004	29.4%
Central Region	42,600	410,090	9,627	24.4%
Pacific Region	25,500	63,200	11,491	3.8%
Territories Region	17,000	121,000	7,118	7.1%
T o t a l :	187,100	1,683,490	8,998	100.0%

Source: Anuario Estadísticas del Sector Agropecuario, Mag/OPSA 1985.

Table 13. Colombia, Cassava, Consumed quantities, DANE/DRI Survey, 1981.

		Kilos Per Capita					
Atlantic		1	2	3	4	5	Total
	Urban	42.2	47.5	46.5	47.6	30.7	42.3
	Rural	61.8	73.2	77.0	81.0	82.0	72.6
	Total	54.3	61.4	59.7	56.0	39.4	54.4
Eastern							
	Urban	15.5	24.9	23.7	29.9	20.0	23.6
	Rural	39.5	37.6	46.1	32.4	36.8	39.0
	Total	31.9	61.4	59.7	56.0	39.4	31.8
Special District		2.9	4.5	6.9	7.4	9.4	7.2
Central							
	Urban	8.7	11.0	14.3	16.2	11.9	12.5
	Rural	29.7	38.3	34.6	43.2	32.2	35.4
	Total	18.0	33.0	21.4	23.5	15.4	20.5
Pacific							
	Urban	5.4	6.5	7.1	10.7	8.7	8.3
	Rural	12.4	17.1	22.2	25.5	23.9	17.3
	Total	9.9	11.9	13.7	13.8	9.7	11.6
Total							
	Urban	13.2	17.0	19.4	21.2	14.3	17.2
	Rural	34.6	41.4	46.6	45.5	44.3	41.1
	Total	24.7	28.5	29.1	26.8	18.3	25.5

Table 13A. Cassava: Percentage of Own-Consumption over Total Consumption by Income Strata, DANE/DRI Survey, Colombia, 1981.

Area	Quintil	Percentage
Urban	1	16.8%
	2	14.7%
	3	14.0%
	4	11.7%
	5	9.7%
	T o t a l :	12.8%
Rural	1	68.2%
	2	65.7%
	3	59.4%
	4	58.1%
	5	45.9%
	T o t a l :	62.2%
Region		Percentage
Atlantic		28.7%
Eastern		51.1%
District		4.2%
Central		54.4%
Pacific		44.1%

Source: Own calculations.

Table 14. Colombia 1960-84. Summary of annual rates of growth.

Consumption per capita		Consumption per capita	
Beef	0.1%	Cassava	2.7%
Pork	1.4%	Potato	3.6%
Poultry	4.4%	Rice	4.1%
		Wheat	1.6%
Total production of poultry		Maize	-2.4%
	6.7%	Plantain	0.3%
Real prices		Total production of cassava	
Beef	-0.4%		5.1%
Pork	0.1%		
Poultry	-3.6%	Real prices	
		Cassava	1.7%
Relative price		Potato	-0.3%
Beef/Poultry	3.1%	Rice	-3.4%
		Wheat	-3.0%
Total Population	2.4%	Maize	-1.2%
Urban Population	3.5%	Plantain	0.8%
		Relative price	
Ing. Real Per Cap. 1.9%		Cassava-Wheat	4.7%
		Animal concen- trated	10.5%

Table 15. Colombia, Cassava, Percentage of food consumption.

		1	2	3	4	5	Total
Atlantic							
	Urban	4.6%	2.9%	2.7%	2.2%	1.3%	2.2%
	Rural	7.1%	6.7%	4.8%	4.0%	3.0%	5.2%
	Total	6.1%	4.9%	3.6%	2.6%	1.5%	3.2%
Eastern							
	Urban	1.9%	2.1%	1.6%	1.7%	1.1%	1.6%
	Rural	6.4%	2.9%	3.3%	2.2%	2.8%	3.5%
	Total	5.0%	2.6%	2.4%	1.9%	1.7%	2.6%
Special District		0.8%	1.0%	1.0%	0.9%	0.8%	0.8%
Central							
	Urban	1.7%	1.5%	1.5%	1.4%	1.2%	1.4%
	Rural	3.9%	3.8%	3.3%	2.5%	2.7%	3.3%
	Total	2.7%	2.6%	2.2%	1.7%	1.4%	2.0%
Pacific							
	Urban	1.3%	1.1%	1.0%	1.1%	0.8%	1.0%
	Rural	1.7%	2.4%	2.0%	4.5%	1.4%	2.4%
	Total	1.6%	1.7%	1.4%	1.8%	0.8%	1.4%
Total							
	Urban	2.0%	1.7%	1.6%	1.4%	1.0%	1.4%
	Rural	4.8%	3.9%	3.5%	3.1%	2.7%	3.6%
	Total	3.4%	2.8%	2.3%	1.8%	1.2%	2.0%

Table 16. Colombia, Cassava, Caloric Contribution by Adult Calorie Equivalent.

Quintil	1	2	3	4	5	Total
Atlantic						
Urban	9.8%	7.4%	6.3%	5.2%	3.0%	5.3%
Rural	15.4%	16.5%	12.6%	9.5%	9.9%	13.4%
Total	13.1%	12.7%	9.2%	6.4%	4.2%	8.5%
Eastern						
Urban	2.9%	3.8%	2.7%	3.3%	2.1%	3.0%
Rural	12.9%	7.5%	7.9%	4.5%	6.5%	8.2%
Total	10.2%	6.3%	5.5%	3.8%	3.9%	5.9%
Special District	0.7%	0.8%	0.9%	0.9%	1.0%	0.9%
Central						
Urban	1.9%	1.5%	1.8%	1.7%	1.5%	1.6%
Rural	7.0%	6.6%	5.3%	5.3%	4.0%	5.9%
Total	4.4%	4.1%	3.2%	2.8%	2.0%	3.3%
Pacific						
Urban	1.9%	1.1%	0.9%	1.0%	8.8%	0.9%
Rural	2.6%	2.6%	2.2%	3.6%	3.4%	2.7%
Total	2.0%	1.9%	1.4%	1.6%	1.1%	1.5%
Total						
Urban	2.8%	2.6%	2.5%	2.3%	1.5%	2.2%
Rural	9.2%	8.0%	7.3%	5.7%	6.0%	7.6%
Total	6.6%	5.5%	4.4%	3.2%	2.2%	4.1%

Table 17. Income Elasticities and Cassava Price by Income Quintile. DANE/DRI Survey, Colombia 1981.

Quintile	Income	Price
1	1.47	-0.84
2	1.23	-0.92
3	0.27*	-0.93
4	0.64	-0.92
5	-0.04*	-0.83
Overall	0.20	-0.88

* Not significant at 10% level.

Table 18. Time Series Elasticities, 1965-84. Per Capita Consumption of Fresh Cassava, Colombia.

Own Price	-0.43 (3.09)
Income	2.51 (1.73)
Urbanization	-1.55 (3.14)
Wheat Price	NO
Rice Price	0.09 (2.16)

Values between parenthesis: t-Student.

Table 19. Percent Share of Main Food Items in Total Food Expenditure, Colombia, 1981.

Food Item	National Average	Urban	Rural
Beff	16.7	17.7	14.3
Dairy Products	10.1	10.5	9.1
Sugar	8.7	8.0	10.4
Vegetables	7.1	7.6	6.0
Fruits	6.7	7.5	4.8
Rice	6.1	5.7	7.2
Oil	6.0	6.1	5.6
Potato	5.0	4.3	6.7
Plantain	5.0	3.9	7.6
Eggs	3.4	3.5	3.1
Bread	3.2	3.9	1.6
Maize	2.6	2.1	3.9
Beans	2.1	2.0	2.2
Cassava	2.0	1.4	3.7
Coffee	1.5	1.3	1.8
Other Cereals	1.5	1.7	1.1
Fish	1.4	1.4	1.5
Poultry	1.3	1.6	0.8
Paste	1.2	1.3	1.5
Green Peas	1.2	1.3	1.0
Pork	0.9	1.1	0.5
Lentils	0.7	0.8	0.4
Soft Drinks	0.7	0.8	0.4
Wheat	0.5	0.4	0.7
Yam	0.3	0.3	0.3
Other Tubers	0.3	0.3	0.3
Pulses	0.3	0.2	0.4
Chicken Peas	0.2	0.2	0.4
Other Food	3.3	3.2	3.1
T O T A L	100.0	100.0	100.0

Table 20. Cereal Imports and Feed Use of Maize, Colombia, 1960-85.

	Rice	Total Imports Maize (1000 TM)	Wheat TM)	Feed Use Maize
1960	0.0	6.0	143.0	129.9
1961	0.0	39.0	162.0	181.5
1962	1.0	0.0	159.0	184.2
1963	3.0	0.0	169.3	217.8
1964	0.0	20.0	183.8	200.4
1965	0.0	-2.0	188.1	184.4
1966	0.0	29.0	225.5	202.0
1967	0.0	32.0	177.6	228.9
1968	0.0	9.0	321.9	175.1
1969	16.0	-18.0	192.7	206.4
1970	-7.6	-6.0	318.6	222.2
1971	-0.4	47.0	348.2	203.0
1972	-4.5	34.0	416.0	206.9
1973	-31.3	125.0	358.8	203.2
1974	-1.9	39.0	438.8	215.3
1975	-115.6	-8.0	326.0	206.0
1976	-120.4	16.0	336.3	238.3
1977	-30.5	100.7	453.0	251.4
1978	-0.5	66.2	451.5	286.3
1979	-38.1	62.3	507.6	331.3
1980	-60.1	192.6	539.7	269.1
1981	-33.3	79.6	503.2	282.3
1982	0.0	89.5	567.2	300.9
1983	-35.3	68.7	599.6	283.6
1984	-40.4	0.0	632.6	287.4
1985	-52.3		628.1	

Table 21. Projections for Time Series Model for the year 2,000
Colombia.

DRIED CASSAVA

Annual Rates of Growth

Per Capita Real Income	1.0%
Population	1.5%
Real Retail Price Poultry	-1.0%
Sorghum Production	4.0%

VARIABLE LEVELS

	1,984	2,000
Population	27.9	35.5
Per Capita Consumption of		
Beef	27.2	27.2
Pork	5.3	5.9
Poultry	5.0	6.9
Pork Meat Production	149.0	210.1
Poultry Meat Production	140.9	246.3
Total Feed Production	1,578.5	2,785.9
Pork Feed Production	272.1	380.9
Poultry Feed Production	1,207.6	2,151.7
Maize/Sorghum		
Implicit Use	1,026.0	1,818.8
Imports	41.9	632.5

DRIED CASSAVA

Percent in Feed	10.0%	
Required Production		278.6
Maize/Sorghum Imports		353.9
Foreign Exchange Earnings (Mill.US\$)	-	\$28.1
Fresh/Dried Cassava Conversion		2.5
Cassava Yield/Hectare		10.0
Fresh Cassava Labor/ha.		60.0
Dried Cassava Labor/ton.		3.1
Required Fresh Cassava, 1000 tons		523.4
Required Hectares		52,337.6
New Jobs Created		16,043.4

FRESH CASSAVA

Annual Rates of Growth

Per Capita Real Income	1.0%
Population	1.5%
Real Retail Price Fresh Cassava	-1.0%

VARIABLE LEVELS

	1,984	2,000
Population	27.9	35.5
Per Capita Consumption of		
Fresh Cassava	44.5	41.5
Fresh Cassava Production	1,659.4	1,730.9
Commercialization Losses	25.0%	15.0%
Production Increase		71.5
Additional Hectares for Cassava		7,153.0
New Jobs Generated		1,716.6

FINAL BALANCE FOR FRESH AND DRIED CASSAVA

	Consumption		
	Total	Direct	Dried
Additional Production for			
Fresh Cassava (1000)	595	72	523
Required Hectares	59,490	7,153	52,338
New Jobs Generated	17,760	1,717	16,043

	1,984	2,000	1,984	2,000
	1000 Tons		Value Mill.US\$	
Reduction of Annual Losses				
for Fresh Cassava Commercialization				
with New Technologies (10% Fresh,				
10% Feed)	331.9	346.2	\$54.8	\$57.1

Table 22. Time Series Elasticities, Per Capita Consumption of Poultry, Colombia. 1965-84.

Own Price	-0.46 (10.45)
Income	0.88 (10.86)
Beef Price	0.61 (10.86)
Pork Price	-1.14 (5.60)

Values between parenthesis: t-Student.

Table 23. Economic parameters of sorghum production in the Atlantic Coast region of Colombia,
1984.

A. Investments per hectare:

	Nominal Price (US\$)	Correction factor	Corrected Price (US\$)	Economic life time (years)
Tractor + equipment	347	0.83	288	10
Combine	119	0.82	98	10
Spraying Airplane	25	0.65	16	10

B. Production costs per hectare:

	Units Needed	Nominal Price/Unit (US\$)	Correction Factor	Corrected Price (US\$)
Land	1	75	1.0	75
Land preparation	1	77	0.57	44
Seeds	15 kg	1.69	1.0	75
Pre-emergent herbicide	3 liters	4	0.74	9
Application	2.2 hours	4.2	0.57	5
Insecticides	3 flights	7	0.59	12
Application	5 flights	7.5	0.75	17
Fertilizer	100 kg	0.35	0.83	29
Application	1.2 hours	3.3	0.57	2
Harvest	33.6 sacks	1.5	0.57	29
Loading	1	4.35	0.75	3
Transport	1	5.3	0.57	3
Second collection	2 persons	4.2	0.75	6
Other harvest costs		1.67	1	2
Technical assistance	1 person	8.3	0.90	8
Plot management and control	4 mandays	4.2	0.80	13
Other costs		10.8	1.0	11
Costs of first harvest				302
Mowing and Burning	1	8.75	0.80	7
Fertilizer	60 kg	0.35	0.83	17
Application	1 hours	3.3	0.57	2
Insecticides	2 flights	7	0.59	8
Application	2 flights	7.5	0.75	11

Table 23. Cont.

	Units Needed	Nominal Price/Unit (US\$)	Correction Factor	Corrected Price (US\$)
Technical assistance and control	2 mandays	4.2	0.80	7
Harvest	11.2 sacks	1.5	0.57	10
Other harvest costs		5.8	0.90	5
Transport	1 hour	4.9	0.57	3
Benefits from cattle grazing		-4.2	1.0	-4
Cost of rattoon				66
Administration costs	10% of national costs		0.90	45
Transport to mill	2.8 tons	8.3	1.00	23
Total costs				436
Yield:	2800 kg			

C. Cash flow per hectare

	Year 0	1	2	3	4	5	6	Residual value
Investments	-201	-201						161
Costs of extension service	-8	-4						8
Production costs	-109	-436	-436	-436	-436	-436	-327	
Foreign exchange saved		448	448	448	448	448	448	
Cash flow	-318	-193	12	12	15	12	115	169

For further details, see Borren (1983)

Table 24. Economic parameters of dried cassava production in the Atlantic Coast region of Colombia, 1984 ^{1/}

A. Investments per plant:				
	Nominal Price (US\$)	Correction factor	Corrected Price (US\$)	Economic life-time (years)
Concrete drying floor	6562	0.84	5512	20
Warehouse	1650	0.84	1386	20
Fence	93	0.89	83	5
Cover for chipper	75	0.87	65	15
Chipper	626	0.9	563	10
Motor	1187	0.7	831	5
Scale	188	0.66	124	10
Wheelbarrows	225	1.0	225	5
Spades	56	1.0	56	5
Rakes	38	1.0	38	2
Gatherers	38	1.0	38	2
Sacks	750	1.0	750	2
Plastic Cover	938	1.0	938	4
Unforeseen	5% of investments		530	8
Working Capital			5062	
Total Investments			16201	
Cassava Production:				
Tractor + Equipment	15263	0.83	12668	10
B. Production costs of the cassava/maize intercropping system per hectare:				
	Units needed	Nominal price (US\$)	Correction factor	Corrected Price (US\$)
Machinery				
Ploughing	2.5	17.5	0.57	25
Disking	1.0	17.5	0.57	10
Furrowing	10.0	17.5	0.57	10
Internal transport	1.5	14.0	0.57	12

^{1/} Drying plant of 1500 m².

Table 24. Cont.

	Units needed	Nominal price (US\$)	Correction factor	Corrected Price (US\$)
Labor				
Seed preparation	1	4.2	1.0	4
Planting cassava	6	4.2	1.0	25
Planting maize	2	4.2	1.0	8
Chemical weed control	2	4.2	1.0	8
Manual weed control	35	4.2	0.72	105
Pest control	2	4.2	0.8	7
Cassava harvesting	20.7	4.2	0.54	47
Maize harvesting	6	4.2	0.75	19
Inputs				
Maize seed	10 kg	0.18	1.0	2
Insecticides	1 treatment	11.75	0.59	7
Herbicides	1 treatment	16.67	0.74	12
Land	1 ha	75	1.0	75
Administration costs	10% of national costs			10
Benefits from cattle grazing	-4.2			-4
Total costs				405
Cassava yield : 10345 kg/ha				
Maize yield : 1000 kg/ha				

C. Processing costs per plant:

	Units needed	Price/Unit (US\$)	Correction factor	Corrected Price (US\$)
Fixed costs				
Maintenance		423	1.0	423
Administration		1500	0.75	1125
Land-rent		42	1.0	42
Variable costs				
Labor	1008 man-days	4.2	0.5	2100
Fuel	1008 liters	0.125	2.0	252
Transport	403 tons	12	1.0	4838
Other Costs	1008 tons	0.67	1.0	672
Total processing costs				9452

Table 24. Cont.

D. Cash flow per plant:

	Year 0	1	2	3	4	5	6	Residual value
Investments in drying plant	-5569	-5569		-825		-1763	-1196	7113
Working capital	-2531	-2531						5062
Operation costs		-9452	-9452	-9452	-9452	-9452		
Investments in cassava production	-6334	-6334						5067
Production costs	-13139	-39417	-39417	-39417	-39417	-26278		
Institutional investments	-7500	-5625						9469
Foreign exchange saved with maize (corrected for transport costs)		15947	15947	15947	15947	15497	15947	
Foreign exchange saved with cassava		55709	55709	55709	55709	55709	55709	
Cash flow	-35074	2727	22787	21962	22787	21024	34710	26712

For more details on drying plant investments and processing costs, see Janssen and Ospina, 1983.

REFERENCES

Colombia

1. Balcazar, Alvaro. "Cambio Técnico en la Agricultura". En: Absalón Machado ed. 1986.
2. Elías, Victor. Government Expenditures in Agriculture and Agricultural Growth in Latin America, IFPRI Report 50, Washington D.C., 1985.
3. García G. Jorge. The Effects of Exchange Rates and Commercial Policies on Agricultural Incentives in Colombia; 1953-1978. IFPRI Research Report, June 1981.
4. García G. Jorge. Se ha Protegido la Producción de Alimentos en Colombia?. Revista SAC, Bogotá, March 1983.
5. Gómez, G.; J. Santos; M. Valdivieso. "Utilización de Raíces de Yuca en la Alimentación Animal", In: C. Domínguez ed. Yuca; Investigación, Producción y Utilización. CIAT, 1982.
6. IDB. Economic and Social Progress in Latin America (ESPLA). Washington D.C., 1986.
7. Janssen, W.; C. Wheatley. "Urban Cassava Markets", In: Food Policy. v. 10, 1985.
8. Janssen, W.G. Market Impact on Cassava's Development Potential in the Atlantic Region of Colombia. Ph.D. Thesis, CIAT, 1986.
9. Lynam, J.K.; D.P. Pachico. Cassava in Latin America: Current Status and Future Prospects. Unpublished. CIAT, 1982.
10. Machado, Absalón. "La Industria Agroalimentaria". In: Absalón Machado, ed., Problemas Agrarios Colombianos. CEGA, Bogotá, 1986.
11. Montes, Gabriel. "Políticas Macroeconómicas y Desarrollo Agropecuario". Revista SAC, March 1983.
12. Prieto, G.; Sarmiento, A.; Perez, A. "La Política Agropecuaria 1982-1986. In: Economía Colombiana, Nos. 184-185, 1986.
13. Rivas, L.; Sere, C.; Sanint, L.R.; Cordeu, J.L. El Sector Carnes en Latinoamérica. Proyecto FAO/CIAT. To be printed.
14. Sanint, L.R. Demand for Carbohydrate Foods in Colombia and Venezuela. USDA/ERS FAER 187, 1983.

15. Sanint, L.R.; Rivas, L.; Sere, C.; Duque, M.C. "Análisis de los Patrones de Consumo de Alimentos en Colombia a partir de la Encuesta de Hogares DANE/DRI de 1981. Revista Planeación y Desarrollo, Bogotá, Vol. XVII, No. 3, Sept. 1985.
16. Thobany, Mateen. "Colombia: An Analysis of Agricultural Pricing and Trade Policy". In: World Bank, Report 4981-CO, Washington D.C., 1984.
17. Valdés, A. "Impact of Trade and Macroeconomic Policies on Agricultural Growth: The South American Experience". In: IDB, ESPLA 1986 Report.
18. World Bank. "Colombia: External Sector and Agriculture Policies for Adjustment and Growth". 2 Volumes, Report 4981-CO (for Official Use Only). Washington, D.C., April, 1984.
19. World Bank. "Rural Financial Markets Sector Study". 2 Volumes (Confidential Report), Washington, D.C., 1986.

- PARAGUAY POTENTIAL DEMAND FOR CASSAVA -

I.	Macroeconomic Policy and Agriculture	1
A.	Economic Policy Context	1
B.	The Policy Environment	2
II.	Agriculture in Paraguay	3
A.	Specific Agricultural Policies	5
1.	Colonization	
2.	Price and Commercialization Policies	6
3.	Credit	7
4.	Research and Extension	8
B.	Concluding Comments	8
III.	Status Quo of Cassava in Paraguay: Supply and Distribution	8
A.	Present Status	8
1.	Fresh Cassava Production and Consumption	9
2.	Econometric Analysis of Demand for Fresh Cassava	10
3.	Other Uses	10
4.	Problems and Opportunities in Cassava Production	11
B.	Potential Demand for Cassava	12
1.	Carbohydrate Foods	13
2.	Meat Consumption	14
C.	Projected Demand for Cassava	16
1.	Basic Assumptions	16
2.	Fresh Cassava Consumption	17
IV.	Concluding Comments	17

PARAGUAY: POTENTIAL DEMAND FOR CASSAVA.-

I. Macroeconomic Policy and Agriculture.

In this section, the evolution of the Paraguayan economy in the light of the set of policies implemented is analyzed. Emphasis is placed in the role of agriculture and within it, the role of cassava. As it is well known, Paraguay is by far the largest per capita producer of cassava in the world, with over 750 kilos per year. We will present some explanations for this singular situation in terms of both production and consumption factors influencing this crop.

A.- Economic Policy Context:- Paraguay has had in the past two decades one of the more impressive rates of growth among Latin American countries and the world. Its economy is based on the agricultural sector, which contributes 27% of GDP, 50% of employment and 95% of exports. Agricultural contribution to GDP went from 39% in 1960 to 27% in 1984. Of the current share, 16.2% corresponds to crops, 7.8% to livestock and 2.7% to forestry. Construction, the big winner, went from 1.5% in 1962 to 7.1% in 1981 and to 6.2% in 1984 (Table 1). Stable policies have been the trade mark of this development.

Of the 3.7 million people in the country, 56% still live in the rural areas. Population growth for 1,970-85 was 3.2% per year (Table 2). Urban population grew faster at 4.4%. Per capita income amounts to about US\$1,777 by 1,985.

Recent growth of the Paraguayan economy can be divided in 3 distinct periods. From 1950 to 1971, from 1972 to 1981 and from 1982 to present. In 1950 to 1971 the basis for development was laid out and the country expanded at modest growing rates (4%).

In 1972 the construction activity was accelerated. Itapua and the road to Brazil had a great impact on the economy. In the seventies, Paraguay achieved one of the highest rates of growth of Latin America and the world. Specifically, in 1970-80, Paraguay had the highest rates of annual growth of real GDP at 8.6%, of agriculture at 7.3% and of industry at 10.6% among Latin American countries (Table 3). In 1972/81, the total value of production increased at an annual rate of 7% for crops, 5% for livestock and 6% for forestry (Ground).

The seventies also witnessed a rapid expansion of agricultural exports. Two crops were instrumental to this export growth: cotton (a small farmers crop) and soybeans, with an expansion in 1972-79 of 470% and 350% respectively. Total exports grew at 7% per year and imports grew at 12.5% annually. Exports were quite stable in value and composition (table 4) while imports were mostly related to the infrastructure development that took place with foreign capital.

The road to Brazil (Puerto Stroessner) put an end to trade dependence with Argentina, and in view of the fixed rate policy in effect from 1960 to 1982, illegal trade flourished in Paraguay (Rodriguez Silvero). The country became quite sensitive to disequilibriums created by policies in the two giant neighbours: Argentina and Brazil.

Unemployment went from 5% in 1972 to 2.2% in the first semester of 1982. Labor force expanded at 4% during the period. The inflation rate was under 14% for the period. Real agricultural wages went up by 3.3% per year while labor productivity in the sector increased by 5.5% (Ground).

Despite the rapid economic growth and the expansion of aggregate demand, inflation was controlled by expanding imports and by conducting a fiscal policy that was countercyclical in nature.

The third period starts in 1982. The country felt the slow down of the construction sector and the world recession in a drastic manner. A increased divergence between the official and the free market exchange rate took place. The current account balance has been deficitary since 1978 (Table 5). This, coupled with the drying up of capital inflows that were associated with hydroelectric projects and the rapid rise in international interest rates led to a sharp reduction of international reserves (that went from US\$ 818 million in 1981 to US\$ 352 million in 1985) and to the accumulation of external payment arrears (USDA Ag. Situation Report).

External public debt achieved US\$1.5 billion in 1985. Real GDP decreased for two consecutive years (-1.0% in 1982 and -3.0% in 1983) to resume growth in 1984 and 1985 at 3.1% and 4.0% respectively (Table 2).

Exchange rate distortions have favored contraband. It is estimated that over 30% of all trade is done under that modality. (Rodriguez Silvero, page 371 EP v.1) This fixed rate policy coupled with the acute fluctuations in the general price level and exchange rates that took place in Argentina and Brazil in the past ten years explain the importance of illegal trade in the country and the changes in flow from one country to the other.

Informal channels are of easier access to nonperishable products, that require low degree of elaboration, and have easy access to both markets like soybeans. Cattle is also an example.

B.- The Policy Environment. Given the overwhelming importance of agriculture, it is not strange to find that the main stream of Government action has been directed to promote its development. But direct intervention has been low. Policy actions have been mainly directed at promoting colonization of frontier lands, improve land tenancy, develop better infrastructure and

stimulate agricultural exports.

The highlight of the Paraguayan policy direction has been the occupation and development of the agricultural frontier. Even if the infrastructure developments of Iguazu, Yacyreta and the road to Brazil contributed to this goal, the set of mechanisms designed to relocate families in new colonies and away from the pressure areas surrounding Asuncion, were the key to occupation and creation of new settlements. IRA (Instituto de Reforma Agraria) and from 1963 IBR (Instituto de Bienestar Rural) have been in charge of relocation, land adjudication and redistribution of property.

Another important tool constitutes the promotion of exports, which has been a permanent theme since 1956 when the IMF approved a loan to subscribe to the Stabilization Plan. The Guarani went from 60 to the dollar in that year to 126 by 1960, and stayed at that official level until 1982. Creation of CEPEX in 1969 was instrumental to promote exports (Franco).

Livestock products and essential oils decreased their export participation while cotton and soybeans became predominant (Tables 4 and 5). Import composition was mostly related to the infrastructure development that took place with foreign capital.

Fiscal policy is mostly directed at taxing property. The failure to implement significant new tax measures was the basic factor causing current Government revenue to slip from 9.3% of GDP in 1982 to an estimated 7.9% in 1985, one of the lowest tax burdens of Latin America (IDB, 1,986 Report, ESPLA).

The present exchange rate policy is a weak point in the structure. It counteracts export promotion efforts and drains Government resources. The Guarani is quite overvalued. While the free market rate was above G/600 per dollar during 1,986, the official rate for debt payments is G/126 per dollar and G/240 for commercial transactions. Transfers and subsidies paid by the Government are equivalent to 25% of Government expenditures, mostly because of the burden imposed by the implicit subsidy in the payment of foreign debts (IDB 1,986 Report ESPLA).

On the other hand, this policy is confiscatory of export earnings, and stimulates non-register exports and higher imports, a difficult situation to handle when the country reserves are quite low.

II.-Agriculture in Paraguay.-

Almost all agricultural production takes place in the Eastern region, which covers 37.5% of the area of the country. Chaco (with the other 62.5% of the area) produces only 3% of cotton and 2% of sugar, while livestock is the predominant activity in that region (38% of total in the country)

(Fletschner).

Only wheat and soybean production takes place in large exploitations (above 10 has.). Average area for other crops is around one ha. (Table 6). Food crops have grown at a slower pace than export crops. (Fletschner).

Agricultural production has grown by means of area increases, while yields have remained virtually stagnant. Cultivated area increased at the annual rate of 9.4% in 1972/81, to remain constant in 1982/83 and in 1983/84. After 1984 agriculture reinitiated its recuperation with annual rates of growth of 11% and 15% respectively (Table 7 and USDA Report).

Agricultural exports account for over 90% of total registered exports. Of them, 47% correspond to cotton, 33% to soybeans and 2% to livestock, showing a low degree of export income diversification (Table 4).

After 1978 agricultural prices fell by over 30% with respect to the other products in the economy (Table-8). Internal terms of trade for agriculture have deteriorated. This partially explains the slower growth of the sector in the eighties. Compensatory policies have been directed only to export crops (cotton and soybeans), wheat and sugar cane as well as to livestock, leaving food crops unprotected. In the face of growing inflation, this constitutes a dangerous policy to follow.

Before 1960, livestock was the predominant economic activity and the main source of exports. By 1962, crops contributed slightly more than livestock to sectoral GDP. Today, crops account for two-thirds of agricultural GDP, and displaced livestock products from the dominant position as foreign exchange earners (Tables 1 and 4).

Livestock has reduced its participation in GDP but continues to grow. Beef production exhibits little specialization, with reduced gains in quality and productivity (see Septimo Proyecto de Desarrollo Ganadero, Banco Central).

Hog production is quite important, but is done as a backyard operation. Growth in production has been high. Fresh cassava plays an important role in pork feeding (Regunaza and Kugler, CIAT). There are only a few industrial level operation dedicated to derivatives of pork production.

Poultry production is still quite dualistic, characterized by a scattering of very small scale rural producers and one industrial company (pollos Pechugon) covering 90% of the Asuncion market. Growth in production has been important, based on abundant supplies of feed inputs, namely corn and soybeans.

Within crops, the major contributor in value of output are

soybeans followed by cotton, cassava, and maize in that order (Table 9). Maize and cassava are key products to the settlers of the newly colonized frontier areas. The majority of these two crops is produced for on-farm consumption both as food and as feed. Soybeans and cotton constitute cash crops and are also important in the process of capital accumulation necessary for colonization.

Typically, a 20 ha. lot located in a new colony starts with subsistence agriculture; about 3 has. are initially cultivated. Two hectares go to crops for own-consumption (maize, cassava, cowpea). The other hectare is planted to a commercial crop (tobacco, cotton, petit grain). In a second stage, as deforestation has progressed slowly, the farmer cultivates up to 5 has. Again, 2 has. are for food crops while the other 3 has. go to cash crops (cotton, tobacco, maize, soybeans). By now, he own oxens to prepare the land.

The third stage starts with a large investment to deforest about 6 has. Contracting of land preparation and cultivation is used; local input intermediaries play an important role here.

In the oldest IBR colonies, a fourth stage has been taking place. Purchases, sales and rentals of land started to take place along with more deforestation to widen the property size. Machinery has also been purchased. Soybeans, rotated with wheat are a preferred crop in larger areas together with mechanized corn (see World Bank: Paraguay, Estudio del Sector Agropecuario, 1,984).

Throughout this process, livestock is also acquired and with it, the portion of cassava and maize cultivated to feed the pork and poultry increases. Cassava becomes a strategic crop, not only because of its resistance to droughts, but also because it is available throughout the year. It is not unusual to find cassava stored in the ground for two to three years, in different plots of the farm.

A.- Specific Agricultural Policies.-In Paraguay, Government action has propiciated an adequate environment for agriculture rather than exerted a marked direct intervention on a product by product basis.

Producer prices have roughly followed international prices which reflects the low degree of government intervention. Cotton and soybean (the main export crops) have a Nominal Protection Coefficient close to unity. The only exceptions are wheat, where substantial protection has been enforced in an effort to promote self-sufficiency in this commodity, and sugar cane, used to substitute local alcohol for imported oil (World Bank, op.cit., see Appendix Tables).

Although there are no measurements of the Effective

Protection Coefficient (EPC), in Paraguay use of inputs in agriculture is quite low; consequently the NPC should be a good approximation to the EPC.

Along with the colonization scheme, other policies have contributed to the vigorous expansion of agriculture in the country. The most relevant are those actions referring to price and commercialization, credit and research and extension.

1.- Colonization. Between the agricultural census of 1956 and the one of 1981, the structure of land tenancy suffered profound changes as a result of the actions taken to mobilize families to the new frontier areas of Eastern Paraguay.

Over 59% of all agricultural exploitations censused in 1956, 35% of those censused in 1981 and 85% of the new exploitations between those two censuses, had been created by IRA and IBR. In the Eastern region, the proportion of the area covered by exploitations with more than 20,000 has. decreased from 40% to 20% in that lapse (Ground).

In terms of population growth, between 1962 and 1982, the traditional area of settlements in the SW expanded at 1.8% per year, for minifundia it was even lower at 0.7% while the rest of the Eastern region had a population expansion of 4.0% per year. It is also important to note that urbanization occurred at a slower pace than in other countries of Latin America (Ground). More than half of the population (54%) still lives in the rural sector.

Between 1972 and 1981 agricultural area expansion occurred at 9.4% per year, with export crops leading the growth at 24.5% per year. Food crops expanded at 3.0% per year (Table 7).

2.- Price and Commercialization Policies.- In conjunction with industry, exporters and producers, the Government sets reference prices for cotton and soybeans. There are also minimum prices for wheat and sugar cane. The goal is to obtain foreign exchange with export crops and save it through import substitution.

In an effort to compensate export crops from the increasing overevaluation of the currency, export and import taxes affecting soybeans and cotton have been lowered, and a multiple level exchange rate was designed.

Soybean and cotton manufacturers use a form of forward contracting with producers. Producers get seeds, chemicals and money ahead of planting time. The price of the crop is announced by MAG and is used as a guide in negotiations.

Wheat, which is usually cultivated in rotation with soybeans and mechanized, has been protected by means of import quotas, minimum prices and directed subsidized credit. MAG has silos to

clean and dry it as well as to store it under the system of credit warrants. With an output of 184,000 tons for 1,985, imports still amounted to 82,000 tons that year (USDA Ag. Sit. Report).

The minimum price for wheat in 1985 was G/85/kilo, or US\$142/ton at the free (and fluctuating) rate of about G/600 per dollar. This price encourages inflows from Argentina (of about 75,000 tons or 30% of total) and outflows to Brazil (of similarly large amounts), where the free market minimum price for wheat is higher.

A new element in commercialization of perishable crops was the creation of DAMA (Direccion de Administracion del Mercado de Abasto) in 1982 near Asuncion. It is estimated that over 90% of this type of products reaching Asuncion go through this market first. The most important crop in terms of volume traded here is cassava, with over 40,000 tons per year (Table 10).

The arrival of produce is monitored and daily listings of volumes trades, maximum, mean and minimum prices are available for each product. Price and volume data are posted in the market area so traders can also monitor the current prices levels. Daily, weekly, monthly and yearly reports on volumes and prices are compiled. This will be an excellent source of information when fully operational.

Cassava is the product with the greatest volume traded in this center. 10-12 trucks a day are required to supply the needs of DAMA. Attempts are being made to coordinate this, since sometimes 15 trucks can arrive, causing price falls. The market has also standardized the size of sacks at 50-60 kg roots/sack. During this year a standard size of 25 kg will also be introduced. This is the usual quantity purchased by minoristas, and will therefore avoid repacking.

3.- Credit.- Agricultural credit has a share of about 27% of total credit, which coincides with its contribution to GDP. Credit for crops accounts for about 16% of total while livestock credit participates in 11% of the total (Table 10 A).

The major institutions in charge of administering credit are BNF and CAH for crops, FG for livestock and IBR which makes arrangements for land acquisition. While BNF usually requires property titles as loan collateral, CAH lends to small farmers that are members of associations without requiring collateral. Intermediaries continue to be an important source of credit. The three tools used to provide credit to agriculture are subsidized rates, directed credit (mostly commercial crops and cattle activities) and forced financing (50% of private banks' portfolio, at least). Interest for agricultural credit is around 17% by 1985 with an inflation rate of 26%. Credit for cassava is seldom available (Carter).

4.- Research and Extension.- A clear dichotomy exists between these two activities within MAG. DIEAF conducts basic research while SEAG does applied research and extension.

In 1977, MAG evaluated 21 crops under the following criteria: value of production, exports, imports, volume of production, annual rate of growth, value of industrial production and market perspectives. The resulting ranking by order of importance was cotton, tobacco, soybeans, cassava, wheat and maize. Of these products, cassava is the one that gets less attention from DIEAF which concentrates efforts on cotton, tobacco, soybeans and wheat. (WB V.2 P. 14).

In 1985, SEAG signed an agreement with IDRC and CIAT to conduct cassava research on several aspects of production and utilization. SEAG's main crop programs are cotton, tobacco, wheat, soybeans, maize, rice and cassava at present time.

C.- Concluding Comments.- Direct Government intervention has been low. However, agricultural policies had a clear bias in favor of export crops, livestock, and import substituting crops (wheat and sugar cane).

To compensate for overvaluation of the Guarani, export taxes were lowered and interest rates on credits for those crops were kept low. These measures do not correct the problem while introduce distortions in the internal resource allocation since the vast agricultural production of food crops is kept at a disadvantageous position vis-a-vis export crops. A similar experience in Brazil led to lags in the production of food and a significant food price inflation took place in the eighties. The same situation may be repeated in Paraguay, where inflation is taking off dangerously and food production is not keeping up with the growth in demand.

III.- Status Quo of Cassava in Paraguay: Supply and Distribution.- In this segment, we devote a section to describe the role of cassava both as a basic food staple for human consumption and as a feed source for raising hogs. A demand equation for fresh cassava is estimated to identify the main parameters affecting it. Descriptive information for production and use of cassava and other major carbohydrates and meats is presented in a subsequent section, with the objective of setting up the stage to discuss the immediate and mid-term prospects of cassava production and its use in Paraguay in a third section.

A.- Present Status.- Cassava is the first crop in Paraguay by volume of production and employment generation and third by value of production after soybeans and cotton. As of 1985, its contribution to GDP is of 2.8% (Table 9). Paraguay is the world's largest per capita producer of cassava with over 750 kilos and by total production is second in Latin America, after Brazil, with 2,5 million tons (Table 11).

1.- Fresh Cassava Production and Consumption.- Its per capita consumption is higher in the rural areas, where it reaches around 340 kilos per year (Carter) than in urban areas, where it is of about 120 kilos per year. Total annual per capita consumption is about 260 kilos (Table 11 A).

Only about 15% of production reaches the market (400,000 tons). This figure is the result of urban consumption (about 215,000 tons) plus an estimated 10% of rural consumption that is probably sold for fresh consumption (70,000 tons) and some 115,000 tons that are sold for processing. Our estimates indicate that of the 1 million tons or so that are consumed in fresh form in the country, less than a third is purchased (285,000 tons), while the rest comes from own production.

About 85% of production is destined for on-farm use. It is mainly used as food for the family and as feed for porks and chicken. In the farm sector cassava accounts for about 30% of all calories consumed by the population (Diagnostico de la Situacion Alimentaria...). It plays a fundamental role in the expansion of frontier land because it is quite rustic, has a multiplicity of end uses, requires few purchased inputs, is very tolerant to prolonged droughts (like the one that occurred in 1985/86 in Paraguay) and can be stored in the ground for several years.

With respect to production figures (this section freely uses material from Simon Carter), the 1981 agricultural census recorded 178,937.25 ha. of cassava cultivated in a similar number of exploitations, but did not distinguish between newly sown cassava and old cassava (one year or more). Data in Lynam (1986) show cassava area to be highest in Brazil (1,987,300 ha) followed by Colombia (208,000 ha), and thirdly Paraguay. If we discount Mexico and Barbados, relatively small producers, yield levels, at about 14 tons/ha are the highest in Latin America (Lynam, 1986).

Within Paraguay, production is concentrated in the eastern, wetter, half of the country (Table 11). The area sown to cassava is greatest in the departments of Caaguazu, Itapua and San Pedro. These are areas of relatively recent colonization. Areas of more recent colonization, with small populations, have smaller areas of cassava (Amambay and Canendiyu). Central department has less cassava than its neighbours, despite its high population.

The proportion of farmers growing cassava in the departments of eastern Paraguay is lowest in Central, and highest in Caazapa department. The average area of cassava sown per farm is highest in the departments with the lowest total area, Amambay and Canendiyu. Average area of cassava per farm (in eastern Paraguay) is lowest in Misiones, Central, Paraguari, and Neembucu departments.

In the two departments selected for the SEAG-CIAT-IDRC

projects, Caaguazu and Paraguari, a high proportion of farms (90% and 88% respectively) grow cassava. Caaguazu has the largest number of farms (per department) in Paraguay, and Paraguari the second largest (Carter), but the difference in cassava hectareage between the two is proportionally larger than the difference in number of farms. This is due to the smaller area per farm sown in Paraguari. Because of the recency of colonization in Caaguazu (30-50 years), soils are more fertile than those in Paraguari, where farming is long established.

Cassava production for urban consumption is concentrated in the departments of Caaguazu for the Asuncion market, and Alto Parana, also serving Asuncion and Ciudad Presidente Stroessner.

2.- Econometric Analysis of Demand for Fresh Cassava.- In the absence of a consumers' household food expenditure survey, only time series data were used to calculate the effects of changes in incomes, prices and urbanization trends on per capita consumption of cassava. The period of 1968-83 was analyzed.

Total production of cassava grew at a smaller annual rate (2.3%) than that of the population (3.2%) with the consequent drop in per capita consumption. At the same time, the real retail price of cassava increased at an annual 1.4% (Table 12).

Urban population grew at 4.4% per year. Urbanization has a negative implication on cassava demand that goes beyond the effect of causing higher prices due to the obvious increase in marketing costs. Because the root is highly perishable, urbanization has important repercussions on market structure: reduces competitiveness in the market place, which implies lower volumes being traded.

The model proposed to estimate per capita demand for cassava includes its own real retail price, real retail prices of other carbohydrates, per capita real incomes and total urban population as independent variables.

Parameter estimates show that important determinants in the reduction of per capita consumption of cassava are the higher price for this root and the reduction in the real price of wheat flour. There has been substitution in the consumption of cassava in favor of wheat (cross price elasticity of 0.07), but it has not been very strong.

Urbanization and rising incomes also were factors in the observed reduction (Table 13) but all elasticities are small in absolute value.

3.- Other Uses.- Cassava is also used for starch production in the Eastern part of Paraguay. Starch is produced on a small scale in many households, as well as in a semi-industrialized form in some places. The quality is generally poor, which limits the possibilities for sale.

According to SEAG, 300 farms in the project region also operate the starch processing plants. Taking a mean of 1500 kg/day capacity, and a 20% conversion rate, a total of 300 kg of starch/day is produced. A plant working at a capacity of 1500 kg roots/day for 20 days a month will require 300 tons of roots per year. The total industry in this region therefore needs $300 \times 300 = 90.000$ tons/year. This is double the volume handled by DAMA in Asuncion. Even if somewhat exaggerated, this demonstrates the current size and importance of the starch market to just one cassava producing region of Paraguay and also that starch manufacture is an important utilization which must be considered in any development project.

Large scale industrial plants for producing dried cassava chips have been proposed several times in Paraguay but never implemented. However, a small scale rural industry producing "popi" or sun dried cassava chips for later milling and use as a flour for human food does exist. This remains a small localized industry with little growth prospect due to the apparent preference for cassava starch-based products. A Paraguayan law requires the incorporation of 5% cassava flour from "popi" into all bread, but this is ignored due to bad experiences 15 years ago: quality problems were the main reason given for this, although the availability of cheap Argentinian wheat (contraband) obviously played a part.

4.- Problems and opportunities in Cassava production.

The proposal for the SEAG-CIAT-IDRC Cassava Project (Brun et al. 1985) defines a number of problems of cassava production, and some alternatives for research to seek solutions to these as part of the project. Primarily the systematic loss of soil fertility in old established cassava producing regions around Asuncion (Departments of Central, Cordillera and Paraguari) is identified. Although not stated, this is partly a result of increasing pressure on the land from a growing population, and the consequent reduction in size of farms and bush-fallow periods.

Cassava production for the Asuncion market has therefore shifted to more recently colonized areas. particularly Caaguazu, where soil fertility is higher and higher yields a result of this. It is admitted, however, that the same soil problems are likely to develop there, since no change in agricultural practices has occurred. In fact, most farmers in Caaguazu have moved from the central areas which surround Asuncion.

Cassava from Caaguazu is of better quality and cheaper than that from areas nearer Asuncion. However, the greater distance to market means that deterioration of roots increases before they reach the consumer, and they cost more. The quality of roots varies greatly and a high proportion are rejected.

Brun et al (1985) identify opportunities for improving on-farm animal feeding using cassava, and for improving starch production and starch quality. They underline the need to characterize and classify the diverse cassava germplasm which Paraguay possesses. The project's broad objective is to make available suitable technologies to increase production, productivity and the processing of cassava in Paraguay. The project will test available post-harvest technology, and include studies of actual production processes, on-farm feeding and socio-economic conditions.

The project also has an important agronomic research component. Methods of improving actual production systems using technology already developed by CIAT (such as selection of seed, planting densities and seed storage) will be tested under Paraguayan conditions. Experiments using legumes as protective cover crops, and legume rotations will attempt to address the soil fertility problem. Successful components will then be diffused over large areas.

B.- Potential Demand for Cassava.- Demand for human consumption of fresh cassava is very strong. This causes a high farm price for the root, making cassava production one of the most profitable crop activities in the country and one that requires little use of limited resources, specially capital while needing basically large amounts of a more abundant resource like labor. Its use in feeding porks make the root an indirect source of protein and of cash to rural families (World Bank).

Loking into the future, the high price paid to farmers make use of dried cassava in animal balanced food ratios economically less attractive at present to both farmers and food manufacturers than fresh cassava and corn. This does not mean that present price relationships are not going to change, perhaps making the dried cassava alternative profitable in the future. For that reason, it is important to keep abreast of the technical implications of this activity in the country.

The prospect for dried cassava as an animal feed depends on technical factors also. The long cold season (May-September), which is also the driest part of the year, makes natural drying in Paraguay a different prospect from that of the tropical regions in which we have most experience. A small pilot plant would be required in order to determine the technical feasibility of drying under these conditions. Possibly, tray drying could be used to take advantage of wind during the colder season. Popi is produced by drying on trays.

A possibility does exist for the production of cassava chips for export, although the economics of this are unclear under the present exchange rate policy of Paraguay. The Instituto Nacional de Tecnologia (I.N.T.) has experience in cassava drying both for

human and animal feed and on large (industrial) and small (rural) scales of production. This would be an obvious cooperating institute in any project.

We turn now to analyze the prospects for cassava demand both as a food item that competes in consumption with other carbohydrates and as a feed source mainly for pork and poultry.

1.- Carbohydrate foods.- Among the five major carbohydrates destined for human consumption in the country, cassava accounts for two-thirds of them, volume-wise, and supplies one-half of the total calories provided by those (Table 11). Per capita rice consumption is still low (11 kg.) by Latin American standards, corn and wheat (at around 35 kg. a piece) have increased their share and sweet potatoes have had a substantial decline.

The most notorious change in prices has been the rapid reduction in the real retail price of wheat flour during the period 1968-83, at 2.1% per year, although per capita consumption of wheat did not show a significant increase associated with the important price drop. Among the major carbohydrate foods, cassava was the only one that registered a sustained price increase during the period of analysis, 1968-83 (1.4% per year), implying that production did not keep pace with demand for the root.

The fastest increase in per capita consumption occurred with rice (at 2.3% per year) in response to lower prices (its real retail price had a growth rate of -1.2% per year). This was possible due to the rapid adoption of improved varieties (mainly CICA type), which now cover two thirds of total area planted to rice (Dalrymple).

Per capita consumption of corn also increased in response to lower prices during 1968-83. Corn production increases (8.5 per year) were mostly the consequence of area expansion (at 6.5% per year); yields have remained low at 1.5 tons/ha (MAG, Informe sobre el Maiz en el SE).

About 35% of corn produced in Paraguay is destined for human consumption, 25% goes to the food industry and 35% is fed directly to animals (MAG-Informe sobre el panel de Maiz en el SE del Paraguay). Corn is a favored activity by lenders given the easyness for credit recovery. Storage capacity is sufficient. Its profitability is similar to that of soybeans. Given the existence of hybrid varieties with ample spectrum for planting dates, corn can play an important role in the newly colonized areas in the Eastern part of the country, specially in the South East, where soil and climate conditions are good. In that area, corn competes with soybeans and wheat.

Sweet potatoes have registered the fastest reduction in per capita consumption due to stagnation in production and area planted.

Prospects for cassava production are good, given the important role that the crop plays in the expansion of frontier lands and in view of the renovated interest shown by the Government in this crop. Corn is also likely to continue its vigorous expansion should the tendency to become more commercially oriented continue. Incentives for this crop are good and it stands high among official priorities.

Rice production can grow fast given the low average national yields at present time (around 2 tons/ha) and a move towards irrigated areas under improved varieties. A substantial real price reduction could take place under these circumstances. However, increases in per capita consumption will not be important volume-wise since demand is still low (11 kilos per year).

Wheat is expected to continue its response to the protectionism built around it, although yield increases have not been as important as area expansion and further price reductions will be at the expense of higher subsidies or increased contraband from Argentina. Expansion of soybean area favors wheat production as well. The opportunity cost for wheat under this type of rotation is much lower than in the case of single cropping.

In other words, past trends observed in carbohydrate consumption are quite likely to prevail in the mid-term.

2.- Meat consumption.- Paraguay has been characterized by a relatively high per capita consumption of meats. However, the change in composition among the three dominant types of meat has been important during the past two decades (Table 14).

Per capita beef consumption was around 50 kilos in 1968 followed by pork (17 kilos) and poultry (3 kilos). By 1984, per capita consumption of beef was down to 29 kilos, pork went up to 25 kilos and poultry reached almost 5 kilos. Poultry had the fastest annual growth in per capita consumption at 3.2%.

It is very difficult to establish trends for livestock production. For beef the quality of the data is poor while pork and poultry production are still quite dualistic in nature with a small segment of producers being industrialized.

Beef products were the main source of exports in the sixties but today these are almost nil. This fact coupled with the reduction in per capita consumption at 3.2% imply a reduction in total beef production. However, this does not seem to be the case. Although productivity is not high (steers are sacrificed at 4-5 years of age weighting only about 350 kilos, with a 50% conversion to carcass and extraction is estimated at about 10% on the basis of 7 million head (or 700,000 head), by 1985 there has been increases in pastures area and improvements in management

systems that create doubts about total production figures.

The World Bank estimates and extraction rate of 13%, which on the basis of about 10 million head (or 1,300,000 head), produces a 600,000 head difference with official figures. This surplus is estimated that goes to Brazil, as contraband, by foot. Given the vast dry, flat frontier and the favorable policies for beef of that country it is quite easy to maintain this type of activity.

Hog livestock estimates for 1985 are 1.2 million head. There are only a few industrial level operations dedicated to derivatives of pork production. Pork production in Paraguay is done by small enterprises and with traditional methods. Almost all exploitations in the Eastern region (80%) have porks (Regunaza-Kugler p. VI-18) and 97% of pork production comes from that region. The extraction rate is quite low (106%) while carcass weight at 1.5 years of age oscilates around 62 kilos/head. Efficiency is low and only native breeds are found.

Pig nutrition is based on corn and fresh cassava, complemented with milk whey, leftovers and cocotero (the fruit of a wild palm abundant in the region, *Acrocornia Selerocarpa*, which is an important source of protein). No additives are used to supplement this energy-based nutrition. The system is a very low cost alternative since a minimum of management is involved (1.7 hours per day for a 1-4 kg exploitation) and is usually done by family labor (Regunaza & Kugler, p. VI-22).

About one half of pig meat production is destined for home consumption and the other half is sold. This is another important source of liquidity for the system, that has a great deal of flexibility and can be adjusted to meet cash needs as they arise. Cash is an important constraint to small farmers in new settlements (S. Carter).

Production of chicken is dualistic in nature with commercialization of broilers dominated by one company (Pechugon with 90% of the Asuncion market) and a scattering of small backyard operations that complement food and cash requirements to rural farmers.

Should present trends continue, both pork and poultry will see their market shares expanded at the expense of beef. The feed industry is likely to experiment rapid growth with ensured supplies of corn and soybean meal allowing for cost reduction and rapid expansion of poultry.

Pork production is going to be favored from the increased number of new settlements entering the colonization process, and the increasing beef prices that result from growing contraband with Brazil.

C.- Projected Demand for Cassava.- The potential in Paraguay for the technology of storing fresh cassava in plastic bags is enormous given that (a) the treatment is economic, (b) storage losses are sufficient to warrant use of the treatment and (c) volumes of cassava traded are quite important. Any reduction in waste will have a significant impact on the efficiency of resource use and allocation.

Use of dry cassava in animal food is not economically attractive at present. The farmer could sell its fresh cassava at G/15 per kilo to the drying plant, and at that price, dried cassava from the plant could compete with corn. But the farmer will prefer to either sell the cassava in the fresh market at about G/30 per kilo or grow corn for the feed industry and in both cases will have better returns than drying cassava (Table 14A).

Assuming that dry cassava enters at 10% in food formulations (substituting 18,200 tons of corn as of 1984) about 45,000 tons of fresh cassava would be needed or 1.5% of total production for one year. This amount is less than half of what has been estimated that is used for starch production.

Use of fresh cassava as animal feed on the farm was estimated at about 835,000 in 1984. This figure is quite impressive and indicates that a major effort should be done to better understand the role of cassava in the system.

It is quite clear that cassava is of paramount importance in the process of frontier expansion undertaken by the Government of Paraguay, a process that can continue for a long period of time given the endowment of land suitable for production that has not been colonized (about 90% of land suitable for crops in the country is unexploited, Fletschner, p. 52) and also given the rapid rate of growth of the population.

1.- Basic Assumptions.- Using the model estimated for demand for fresh cassava, total demand is projected to the year 2000. From that projection, additional production is calculated and the amount of new hectares cultivated is also shown, as well as the number of new jobs required.

The following rates of annual growth for 1983-2000 are assumed: a) Population growth will continue at 3.0% per year. b) Real GNP will grow at a moderate 4.5%, i.e., per capita GNP will grow at 1.5%. c) The real retail prices of cassava and wheat flour will decrease at 1.0% per year. It is assumed that, with the adoption of the new storage technology for cassava, this goal is easily attained. Wheat subsidies are supposed to continue, allowing a decrease in its real price too.

It is also assumed that the proportions of fresh cassava that are used for human consumption and to feed porks remain unchanged. Yields remain at 13.9 tons/ha.

The proportion of waste in commercialization of cassava is assumed to be reduced from 20% to 10% with the use of the new storage technology, ameliorating losses and allowing an increase in consumption of considerable magnitude based on those savings.

2.- Fresh Cassava Consumption.- Under these conditions, it was estimated that per capita consumption for the year 2000 will be 242.8 kilos (down from 271.9 kilos in 1,983). Given the population increase and the assumption of constant proportions in use, total cassava production will have to increase by 1,095,000 tons, 78,800 new hectares (43% increase) will be required and 21,122 new jobs will be generated (Table 15).

Savings in commercialization, assuming a waste reduction of 10% in trade of fresh cassava, valued at G/35 per kilo and with a free market rate of G/600 per dollar reach the US\$2.1 million each year by the year 2000.

IV.- Concluding Comments.-

The importance of cassava in Paraguay is evident even to the outside casual observer. It is found virtually everywhere in the Eastern region of the country. It is the crop that generates more employment and produces the most, volume-wise, while in terms of GDP contribution is the third, after soybeans and cotton. It is the most important source of carbohydrates and, together with maize, constitutes the basic source for pork feeding. Porks supply 43% of all meat consumed in the country and its consumption has been growing faster than the rate of growth of the population.

In the colonization process, cassava is fundamental as a convenient and reliable source of human food. It can generate cash when sold or indirectly by feeding animals. It is always present in over 90% of all exploitations censused, the most common of all crops. Since the establishment of the new settlement through its modernization, farmers continuously cultivate about one ha. of cassava. The root can be stored for periods of two or more years.

The government has intervened little in agriculture, at least in a direct manner, allowing for market forces to dictate the output.

Export and import substituting crops have been favored through price support and credit policies but, in general, farmer prices for most crop are well aligned with world prices.

Although cassava has not been directly favored by the prevailing price and credit policies, the colonization policies together with improvement of infrastructure (roads and the sholesale market DAMA) have resulted in expansion of production beyond levels that were already quite high. They also resulted in

a more efficient system of commercialization for fresh cassava.

The present project signed by SEAG/IDRC/CIAT in 1985 to explore aspects of production and utilization shows the high priority that the crop has for the economy of the country. Two basic aspects of research in cassava demand and use merit great attention: (i) adoption of the new storage technology to store cassava in plastic bags and (ii) the role of fresh cassava in pork feeding.

Prospects for production are good, given the important role that the crop plays in the expansion of frontier lands (a continuing process) and in view of the renovated interest that the Government has shown for the crop recently. Demand needs will continue to grow and if yields remain the same, close to 80,000 new hectares will have to be cultivated by the year 2,000 to satisfy this growth.

Table 1. Structure of Gross Domestic Product by Economic Sectors.

	(% Over Constant Values of 1982)							
	1960	1970	1975	1980	1981	1982	1983	1984
Crops		16.1	16.7	14.5	15.3	15.6	15.6	16.2
Livestock		11.0	11.0	7.9	7.4	7.7	7.8	7.8
Forestry		3.2	3.0	2.7	2.6	2.5	2.5	2.5
Wildlife and Fisheries		0.1	0.1	0.1	0.2	0.1	0.2	0.2
<u>Sub-Total Production Primary</u>	<u>38.8</u>	<u>30.4</u>	<u>30.8</u>	<u>25.2</u>	<u>25.5</u>	<u>25.9</u>	<u>26.1</u>	<u>26.7</u>
Mining	0.1	0.1	0.2	0.3	0.4	0.4	0.4	0.4
Industry	17.3	18.4	16.8	17.6	16.8	16.4	16.2	16.4
Construction	2.4	2.4	3.2	6.6	7.1	6.7	6.5	6.2
<u>Sub-Total Production Secondary</u>	<u>19.8</u>	<u>20.9</u>	<u>20.2</u>	<u>24.5</u>	<u>24.3</u>	<u>23.5</u>	<u>23.1</u>	<u>23.0</u>
<u>TOTAL PRODUCTION OF GOODS</u>	<u>58.6</u>	<u>51.3</u>	<u>51.0</u>	<u>49.7</u>	<u>49.8</u>	<u>49.4</u>	<u>49.2</u>	<u>49.7</u>
Electricity	0.6	0.8	1.2	1.8	1.7	2.2	2.1	2.1
Water and Sanitary	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4
Transportation and Comm.	4.0	3.9	4.6	4.3	4.1	4.2	4.3	4.3
Trade	18.4	26.5	25.3	27.0	27.0	26.6	26.6	26.3
Central Government	4.4	5.7	4.3	3.8	4.2	4.5	4.5	4.5
Housing	3.6	3.6	3.3	3.1	3.1	3.0	3.0	2.9
Other Services	10.2	8.0	10.1	10.0	9.8	9.8	9.9	9.8
<u>TOTAL PRODUCTION OF SERVICES</u>	<u>41.4</u>	<u>48.7</u>	<u>49.0</u>	<u>50.3</u>	<u>50.2</u>	<u>50.6</u>	<u>50.8</u>	<u>50.3</u>
<u>TOTAL GDP</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>
=====	=====	=====	=====	=====	=====	=====	=====	=====

Source: División de Estadística y Cuentas Nales. Secretaria Técnica de Planificación, con datos del Banco Central del Paraguay.

TABLE 2

Statistical Profile*

Area (Km ²)	405,752				
Population: Total 1985 (43.9 % urban)	3,691,000				
Annual growth rate 1970-85	3.2				
Birth rate (1984)	38.9				
Mortality per 1000 inhabitants (1984)	7.7				
Infant mortality per 1000 live births (1984)	52.9				
Life expectancy at birth (1984)	68.0				
Percentage of literacy (1984)	92.0				
Labor force by sector (1982)	(Percentages)				
Agriculture	46.9				
Mining	0.1				
Manufacturing	13.6				
Construction	7.5				
Others	31.9				
	1981	1982	1983	1984	1985**
Real Production	(Growth rates)				
Total GDP (market prices)	8.7	-1.0	-3.0	3.1	4.0
Agricultural sector	10.1	0.4	-2.4	5.9	4.6
Manufacturing sector	4.3	-3.7	-4.2	4.5	5.0
Construction sector	16.7	-6.0	-5.7	-2.4	-1.0
Commerce sector	8.4	-2.2	-3.1	1.8	4.8
Central Government	(Percentages of GDP)				
Current revenues	8.3	9.3	8.0	8.0	7.9
Current expenditures	7.5	8.7	8.9	7.6	7.0
Current savings	0.8	0.6	-0.9	0.4	0.9
Capital expenditures	3.7	2.1	1.7	3.3	2.5
Deficit or surplus	-2.8	-1.5	-2.6	-2.9	-1.5
Domestic financing	2.5	1.5	1.9	1.9	1.8
Money, prices and salaries	(Growth rates)				
Domestic credit	36.9	9.3	23.1	20.0	17.7
Public sector	59.3	77.5	228.8	28.6	42.2
Private sector	15.4	5.4	2.6	17.3	9.2
Money supply (M1)	-14.0	-7.6	22.7	32.0	25.8
Consumer prices (annual average)	14.0	6.7	13.5	20.3	25.2
Real wages	5.3	-2.8	-7.1	-3.5	-2.2
Exchange rate	(Annual Average)				
Official rate (national currency units per dollar)	126.0	126.0	201.0	240.0	240.0
Real effective exchange rate (Index 1980 = 100)	101.4	105.4	119.0	132.7	168.2
Terms of trade (Index 1980 = 100)	104.6	88.0	83.8	112.7	105.9
Balance of payments	(Millions of dollars)				
Current account balance	-374.4	-365.3	-247.4	-313.2	-106.3
Merchandise balance	-373.8	-296.8	-225.3	-287.8	-125.0
Merchandise exports (FOB)	398.6	373.3	326.0	361.3	322.9
Merchandise imports (FOB)	-772.3	-670.1	-551.4	-649.1	-447.9
Net services	-6.4	-73.1	-28.1	-34.7	4.6
Capital account (net)	431.0	319.4	239.3	282.0	70.5
Change in net reserves (= increase)	-43.4	58.9	-3.1	-14.7	88.7
External public debt	(Millions of dollars)				
Disbursed debt	709.2	940.0	1,145.1	1,286.7	1,460.4
Debt service actually paid	70.7	80.7	84.5	117.6	226.8
Interest payments/export of goods and NFS	5.1	6.6	8.9	6.9	9.6

* Where necessary, the items of information presented in this table are defined in the list of sources appearing on page 343.

** Preliminary estimate.

n.a. Not available.

Cuadro No. 8
CRECIMIENTO DEL PRODUCTO
(Tasas anuales medias)

Países	1		2		3	
	PIB TOTAL		AGRICULTURA		INDUSTRIA	
	1960-70	1970-80	1960-70	1970-80	1960-70	1970-80
Argentina	4,3	2,3	2,4	2,3	5,9	2,0
Bahamas	—	—	—	—	—	—
Barbados	6,3	2,0	—	2,5	—	1,3
Bolivia	5,6	4,5	3,2	3,2	7,4	3,9
Brasil	6,1	8,8	3,1	5,2	6,0	9,5
Colombia	5,2	5,9	3,8	4,7	5,9	4,9
Costa Rica	6,1	5,6	5,6	2,4	8,0	8,0
Chile	4,5	3,1	2,3	2,2	5,2	1,7
Ecuador	5,3	7,6	2,5	4,1	6,9	8,9
El Salvador	5,6	3,0	3,9	2,0	7,5	3,0
Guatemala	5,5	5,6	4,4	4,8	6,9	7,3
Guyana	3,2	4,5	0,9	1,9	4,2	3,1
Haití	0,6	4,2	0,9	2,2	0,6	7,1
Honduras	5,2	3,8	5,4	1,9	6,2	4,9
Jamaica	5,6	-0,3	1,4	2,8	6,4	-2,2
México	7,0	4,5	3,7	2,4	8,6	6,9
Nicaragua	6,9	1,2	6,0	1,3	10,7	1,2
Panamá	7,8	3,8	5,3	1,4	10,4	1,5
Paraguay	4,4	8,6	3,0	7,3	6,5	10,9
Perú	5,0	3,1	4,2	-0,6	5,1	3,6
República Dominicana	5,1	6,3	2,3	3,4	7,2	8,5
Suriname	7,4	2,9	—	6,0	—	0,7
Trinidad y Tobago	4,2	4,9	—	-0,4	—	5,1
Uruguay	1,6	3,2	3,0	0,5	0,9	4,7
Venezuela	6,0	4,5	5,3	3,8	3,9	2,2
América Latina	5,7	5,8	3,4	3,3	6,3	6,2

Fuente: CEPAL.

Table 4. Paraguay Export Commodity Composition.

(Percent Distribution)					
	1960	1970	1975	1981	1985
Wooden Products	14.9	19.7	15.8	12.3	3.2
Livestock Products	35.2	26.7	19.5	2.3	2.3
Tobacco	5.9	9.0	6.8	2.2	2.0
Cotton	1.1	6.3	11.4	43.7	45.5
Soybeans	-	-	9.9	16.1	31.7
Sugar	0.3	-	3.8	-	1.1
Vegetable Oils	5.7	10.9	6.0	7.6	5.5
Essential Oils	3.7	3.2	5.5	2.2	1.8
Quebracho Extract	10.9	3.1	1.4	1.9	1.3
Other	7.4	21.1	19.9	11.7	3.5
T o t a l :	100.0	100.0	100.0	100.0	100.0

Source: Banco Central del Paraguay, Boletín Estadístico.

Table 4 Paraguay Import Commodity Composition.
(Cont.)

(Percent Distribution)

	1970	1981
Food	8.2	6.4
Other Consumption Items	14.4	21.0
Primary and Intermediate Goods	39.3	17.0
Fuels and Lubricants	16.4	18.8
Capital Goods	21.7	36.8
T o t a l :	100.0	100.0

Source: Banco Central del Paraguay: Boletin Estadistico.

TABLE 5

COMERCIO EXTERIOR DEL PARAGUAY
 Importaciones CIF, y Exportaciones FOB)
 (en millones de dólares)

IMPORTACIONES	1970	1978	1979	1980	1981	1982
PRODUCTOS AGRICOLAS	10,0	26,1	37,3	38,3	42,6	35,6
Trigo y subproductos	(4,3)	(4,9)	(8,3)	(11,1)	(13,9)	(6,8)
Frutas	(0,1)	(0,9)	(1,0)	(1,1)	(1,7)	(2,2)
Tabaco	(3,7)	(10,7)	(17,3)	(14,3)	(10,0)	(11,7)
COMBUSTIBLES Y LUBRICANTES	6,1	59,6	87,5	129,5	94,6	154,2
OTROS	47,7	232,0	312,7	349,2	368,9	391,7
TOTAL IMPORTACIONES	63,8	317,7	437,7	517,1	506,1	581,5
EXPORTACIONES						
PRODUCTOS AGRICOLAS	26,0	192,6	242,2	229,5	240,6	268,6
Algodón	(4,0)	(100,0)	(98,6)	(105,8)	(129,3)	(122,4)
Soja	(1,5)	(41,6)	(81,3)	(45,3)	(52,5)	(91,0)
Aceites Vegetales	(7,0)	(16,8)	(19,1)	(17,0)	(22,4)	(18,8)
Torta y expellers	(2,5)	(3,9)	(8,0)	(21,9)	(14,2)	(12,1)
Tabaco	(5,8)	(9,2)	(8,5)	(10,1)	(6,5)	(5,9)
Hortalizas	(0,3)	(2,4)	(3,2)	(8,1)	(4,3)	(8,4)
Café	(0,9)	(0,2)	(4,2)	(2,3)	(1,3)	(0,3)
PRODUCTOS GANADEROS	18,0	32,3	11,8	4,4	6,8	9,0
Carne	(15,0)	(23,4)	(15,2)	(1,0)	(0,0)	(2,0)
Cueros	(2,4)	(7,9)	(6,2)	(3,1)	(6,6)	(6,8)
PRODUCTOS FORESTALES, etc.	19,4	29,3	48,5	74,7	45,6	51,1
OTROS	0,7	2,8	2,6	1,6	2,6	1,0
TOTAL EXPORTACIONES	64,1	257,0	305,2	310,2	295,5	328,8
BALANCE AGROPECUARIO						
EXPORTACIONES AGROPECUARIAS	63,4	254,2	302,6	308,6	292,9	328,8
IMPORTACIONES AGROPECUARIAS	10,0	26,1	37,3	38,3	42,6	35,6
SALDO	53,4	228,0	265,3	270,3	250,3	293,2
BALANCE COMERCIAL						
TOTAL EXPORTACIONES	64,1	257,0	305,2	310,2	295,5	329,8
TOTAL IMPORTACIONES	63,8	317,7	437,7	517,1	506,1	581,5
SALDO	0,2	-60,8	-132,5	-206,9	-210,6	-251,7

Fuente: Banco Central del Paraguay.

TABLE 6

PRODUCCION AGRICOLA 1981

	SUPERFICIE COSECHADA HAS.	PRODUCCION TOTAL TON.	RENDIMIENTO PROMEDIO KG. x HA.	SUPERFICIE PROMEDIO HAS.
Algodón	243.952	341.647	1.400	1.8
Arroz	23.398	44.478	1.901	1.7
Arvejas	2.040	1.632	800	0.4
Batata	11.304	75.053	6.639	0.4
Caña de Azúcar	48.569	2.154.713	44.350	1.2
Cebolla	2.191	7.789	3.555	0.4
Habilla	8.564	7.377	861	0.6
Maíz	290.812	468.227	1.610	1.0
Mandioca	178.205	2.012.389	11.293	0.9
Maní	35.207	36.041	1.024	0.7
Papa	789	3.018	3.824	0.5
Poroto	49.940	42.184	852	0.6
Soja	396.125	761.185	1.922	13.5
Tabaco	7.706	11.587	1.504	0.6
Tártago	13.953	14.829	1.063	1.1
Trigo	49.222	60.911	1.237	16.1

Fuente: Ministerio de Agricultura y Ganadería. Censo Agropecuario 1981

TABLE 7

PARAGUAY: EFECTOS DE LA OCUPACION DE LA FRONTERA AGRICOLA SOBRE
EL NIVEL DE ACTIVIDAD Y LAS EXPORTACIONES REGISTRADAS
1972-1983^a

	1972- 1981	1973	1974	1975	1976	1977	1978	1979	1980	1981	1981- 1983	1982	1983
(TASAS DE CRECIMIENTO)													
TIERRA CULTIVADA													
Total	9.4	14.2 ^b	14.2 ^b	14.4 ^b	9.1	5.9	5.5	7.9	7.1	7.2	--	--	--
Para el mercado interno	3.0	10.1	13.0	14.5	8.1	-4.9	-3.7	-1.4	6.0	-7.0	--	--	--
Para el mercado externo ^c	24.3	38.3	19.6	13.5	13.2	51.4	19.9	20.8	9.0	29.7	--	--	--
VALOR DE LA PRODUCCION													
AGRICOLA	8.2	7.9	10.9	3.3	4.7	15.6	6.2	6.5	10.6	8.2	--	-4.4	-6.3
Valor bruto	8.9	7.4	13.0	2.3	4.7	16.0	4.9	6.2	10.5	16.1	--	-3.7	-6.3
Consumo interno	3.8	1.1	10.7	-0.9	1.7	2.5	1.1	8.7	4.4	5.2	--	5.9	-2.7
De exportación ^c	26.6	59.1	25.0	16.7	16.7	62.2	13.1	1.2	23.1	35.2	--	-17.0	-12.5
Forestal	7.6	2.5	11.0	9.3	-1.9	9.1	7.9	14.0	12.3	4.8	--	-5.0	-2.0
VALOR DE LA PRODUCCION POR HECTAREA													
Agrícola	-1.1	-5.3	-2.1	-9.7	-4.1	9.1	0.8	-1.4	3.2	1.0	--	--	--
Valor bruto	0.5	-5.9	-1.2	-10.6	-4.8	8.2	0.7	-0.2	3.4	0.7	--	--	--
Consumo interno	-0.1	-8.2	-1.6	-13.5	-3.9	-7.7	5.0	7.3	-1.4	12.9	--	--	--
De exportación ^c	1.8	15.0	4.6	2.9	2.9	7.2	-12.7	-16.3	13.0	4.1	--	--	--
(POR CIENTO)													
CONTRIBUCION ^d													
A la producción													
Primaria	82.3	82.9	84.5	38.6	75.0	36.5	73.2	84.2	60.6	78.0	--	--	--
Total ^e	21.8	26.0	34.4	17.5	14.1	11.0	13.5	17.2	15.4	19.2	--	--	--
Total ^f	28.1	33.5	44.4	22.6	18.2	14.2	17.4	22.2	11.9	24.7	--	--	--
A LAS EXPORTACIONES^g													
Regulares de bienes	93.5	30.9	52.1	114.9	271.1	68.1	--	136.3	31.6	--	--	--	--
Registradas de bienes y servicios	42.5	28.6	38.5	31.6	69.4	41.9	--	82.1	3.1	--	--	--	--

Fuente: Sobre la base de datos de Paraguay. Ministerio de Agricultura y Ganadería y el Banco Central del Paraguay.

a Cifras provisionales, sujetas a revisión.

b Estimación.

c Algodón y soja.

d Por ciento del aumento atribuible al incremento de la tierra cultivada.

e Efecto directo solamente.

f Incluye un cálculo del efecto sobre el transporte, comunicaciones, el comercio y las finanzas.

g Semillas de soja, fibras de algodón, "otros aceites", tortas y expellers y maderas.

TABLE 8

INDICE DE PRECIOS IMPLICITOS
(Guaraníes constantes de 1977)

AÑO	PIB TOTAL	PIB AGROPECUARIO
1958	26,4	23,9
1959	29,6	26,4
1960	34,8	31,9
1961	37,2	33,7
1962	40,5	37,3
1963	41,5	39,0
1964	42,5	40,0
1965	51,6	40,3
1966	45,5	42,4
1967	44,3	39,1
1968	45,1	40,7
1969	46,6	42,7
1970	47,5	44,0
1971	50,3	47,8
1972	54,7	54,1
1973	66,1	72,0
1974	81,7	82,2
1975	87,2	90,1
1976	91,6	91,4
1977	100,0	100,0
1978	110,4	108,6
1979	113,1	133,0
1980	155,5	148,8
1981	181,3	166,1
1982	192,5	165,9

Fuente: Elaborado con datos del Banco Central del Paraguay.

Table 9. Contribution of Agriculture and Crops to GDP. 1984.

Agricultures' Share to GDP		26.7
of which:	Soybeans	20%
	Cotton	15%
	Cassava	14%
	Corn	6%
	Sugar	5%
	Other	40%

Source: USDA = Agricultural Situation Report for Paraguay,
1985.

TABLE 10. Quantity of cassava (metric tonnes)
entering Asuncion's "Mercado Abasto".

Month	Year	
	1982	1983
January	3,203	2,791
February	3,240	3,310
March	3,809	3,878
April	3,545	3,267
May	3,745	4,065
June	3,922	4,762
July	3,914	4,981
August	3,667	5,389
September	3,776	5,205
October	3,890	4,419
November	3,291	3,168
December	3,132	1,787
TOTAL	43,134	47,022

Source: Monthly records.

Mercado Abasto, Asunción.

TABLE 10A

CLASIFICACION DEL CREDITO AL SECTOR PRIVADO POR
ACTIVIDAD ECONOMICA(En miles de millones de guaraníes y en porcentaje)^{1/}

	1960	1970	1980	1981	1982	1983
Total	4.9	19.1	133.2	159.1	174.6	183.1
1. Agricultura	1.3	4.5	17.6	21.6	24.1	29.2
2. Ganadería	0.5	3.2	11.3	13.8	18.3	20.0
3. Industria	1.5	3.4	23.3	28.2	32.4	37.4
4. Comercio	1.1	4.9	34.4	44.3	47.9	42.1
5. Exportación	0.3	2.0	15.2	13.7	12.5	15.3
6. Construcción	—	0.3	20.9	25.1	26.6	27.8
7. Otras	0.2	0.8	10.5	12.3	12.7	11.3
(en porcentaje)						
Total	100	100	100	100	100	100
1. Agricultura	27	24	13	14	14	16
2. Ganadería	100	17	8	9	11	11
3. Industria	31	18	18	18	19	20
4. Comercio	22	26	26	28	27	23
5. Exportación	6	10	11	9	7	8
6. Construcción	—	2	16	16	15	15
7. Otras	4	4	8	7	7	6

Fuente: Cuadro D del Apéndice.

^{1/} La suma de los parciales puede no corresponder exactamente al total a causa del redondeo de cifras y porcentajes.

TABLE 11

Cuadro N° 5: Superficie Cultivada en Miles de Has., Producción en Miles de Tn. y Rendimiento en Tn./Ha. del Rubro Mandioca Correspondiente a las Campañas Agrícolas de 1982/83 y 1983/84.

Departamento	Año 1982/83			Año 1983/84		
	Sup.Cosechada (Miles de Has)	Producción (Miles de Tn.)	Rendimiento (Tn./Ha.)	Sup.Cosechada (Miles de Has)	Producción (Miles de Tn.)	Rendimiento (Tn./Ha.)
Paraguay	180,0	2.502,0	13,9	182,4	2.533,6	13,9
Concepción	9,6	155,5	16,2	9,7	157,1	16,2
San Pedro	21,8	412,0	18,9	22,1	417,7	18,9
Cordillera	13,6	123,8	9,1	13,8	125,6	9,1
Guairá	12,8	121,6	9,5	12,9	122,5	9,5
Caaguzú	31,1	438,5	14,1	31,5	444,2	14,1
Caazapá	12,8	232,9	18,2	13,0	237,9	18,3
Itapúa	24,5	382,2	15,6	24,8	386,9	15,6
Misiones	3,8	51,3	13,5	3,8	51,3	13,5
Paraguarí	17,1	191,5	11,2	17,4	194,9	11,2
Alto Paraná	12,1	220,2	18,2	12,3	225,1	18,3
Central	5,3	15,9	3,0	5,3	15,9	3,0
Neembucú	3,7	25,5	6,9	3,7	25,5	6,9
Amambay	5,2	49,9	9,6	5,2	49,9	9,6
Canindeyú	5,9	83,2	14,1	6,0	85,2	14,2
Pte. Hayes	0,2	3,1	15,7	0,2	3,2	15,8
Alto Paraguay	0,02	0,2	11,5	0,02	0,2	11,6
Chaco	0,01	0,01	12,5	0,01	0,1	12,5
Nueva Asunción	0,001	0,02	15,5	0,001	0,02	15,5
Boquerón	0,4	6,2	15,4	0,4	6,2	15,5

FUENTE: MAG- Dirección de Censo y Estadísticas Agropecuarias.

TABLE 11A

PARAGUAY -- Per Capita Consumption of Major Carbohydrates.-

Year	Cassava	Sweet Potatoes	White Rice	Maize Metric Tons	Wheat	Total Carboh.	-- Percentual Share Among Carbohydrates --				
							Cassava	Sweet Potatoes	White Rice	Maize	Wheat
1968	274.5	51.0	12.2	31.6	32.6	411.9	66.7%	14.8%	3.0%	7.7%	7.9%
1969	274.8	55.3	17.5	31.6	32.3	421.5	65.2%	15.5%	4.2%	7.5%	7.7%
1970	275.3	56.0	26.2	31.6	32.7	431.7	63.8%	15.3%	6.1%	7.3%	7.6%
1971	274.4	65.3	21.7	31.6	32.5	425.6	64.5%	15.4%	5.1%	7.4%	7.6%
1972	273.9	57.4	25.2	30.6	31.2	418.3	65.5%	13.7%	6.0%	7.3%	7.5%
1973	272.4	57.8	28.5	32.8	31.5	423.0	64.4%	13.7%	6.7%	7.8%	7.4%
1974	267.8	53.6	32.3	33.0	31.2	417.9	64.1%	12.8%	7.7%	7.9%	7.5%
1975	263.1	57.4	32.0	36.0	31.0	419.5	62.7%	13.7%	7.6%	8.6%	7.4%
1976	252.1	58.6	38.9	36.6	30.7	416.9	60.5%	14.1%	9.3%	8.8%	7.4%
1977	241.6	58.6	33.3	37.4	31.7	402.6	60.0%	14.6%	8.3%	9.3%	7.9%
1978	235.1	65.4	32.9	37.2	32.2	402.8	58.4%	16.2%	8.2%	9.2%	8.0%
1979	230.0	66.5	33.9	37.0	32.8	400.2	57.5%	16.6%	8.5%	9.2%	8.2%
1980	233.0	37.3	32.1	37.7	33.5	373.7	62.4%	10.0%	8.6%	10.1%	9.0%
1981	231.6	39.1	36.3	37.5	32.6	377.2	61.4%	10.4%	9.6%	9.9%	8.6%
1982	241.3	40.9	37.8	37.6	33.0	390.6	61.8%	10.5%	9.7%	9.6%	8.4%
1983	231.8	41.5	38.9	37.7	37.7	387.6	59.8%	10.7%	10.0%	9.7%	9.7%
1984	257.1	45.8	40.4	37.7	34.1	415.1	61.9%	11.0%	9.7%	9.1%	8.2%

Paraguay, Real Retail Prices of Carbohydrates.-

Year	Cassava	Sweet Potatoes	White Rice	Maize	Wheat	Popul.	CPI
1968	\$19.31	\$23.17	\$111.97	\$111.97	\$88.80	2.17	25.9
1969	\$18.94	\$22.73	\$106.06	\$106.06	\$87.12	2.23	26.4
1970	\$19.31	\$23.17	\$108.11	\$108.11	\$88.80	2.29	25.9
1971	\$17.79	\$21.35	\$99.64	\$99.64	\$78.29	2.36	28.1
1972	\$16.03	\$22.44	\$99.36	\$99.36	\$67.31	2.43	31.2
1973	\$21.05	\$21.05	\$107.89	\$105.26	\$81.58	2.51	38.0
1974	\$25.32	\$25.32	\$111.81	\$111.81	\$94.94	2.60	47.4
1975	\$24.19	\$34.27	\$110.89	\$108.87	\$86.69	2.69	49.6
1976	\$23.21	\$25.15	\$106.38	\$85.11	\$108.32	2.79	51.7
1977	\$24.35	\$24.35	\$95.65	\$102.61	\$90.43	2.87	57.5
1978	\$24.65	\$24.65	\$109.40	\$97.07	\$75.50	2.97	64.9
1979	\$30.92	\$30.92	\$97.50	\$90.37	\$66.59	3.07	84.1
1980	\$24.00	\$24.00	\$82.00	\$83.00	\$65.00	3.17	100.0
1981	\$20.83	\$20.83	\$81.52	\$86.96	\$63.41	3.27	110.4
1982	\$20.12	\$20.12	\$103.24	\$83.99	\$63.87	3.37	114.3
1983	\$18.89	\$18.89	\$96.48	\$105.92	\$65.44	3.47	148.2

TABLE 12

P A R A G U A Y

1968-83

Resumen de Tasas de Crecimiento Anual

Consumo Per Capita		Consumo Per Capita	
Vacuno	-3.2%	Yuca	-1.5%
Cerdos	2.7%	Batata	-3.0%
Aves	3.2%	Arroz	~~2.3%~~
		Trigo	0.5%
		Maiz	1.6%
Produccion Total de Aves		Produccion Total de Yuca	
	3.5%		2.3%
Precios Reales al Detal		Precios Reales al Detal	
Vacuno	-0.4%	Yuca	1.4%
Cerdos	0.1%	Batata	-0.3%
Aves	-0.8%	Arroz	-1.2%
		Trigo	-2.1%
		Maiz	-1.4%
Precio Relativo		Precio Relativo	
Vacuno/Aves	0.3%	Yuca/Trigo	3.5%
Poblacion Total			
	3.2%		
Poblacion Urbana			
	4.4%		
Ingreso real P. C.			
	4.0%		

TABLE 13

Elasticidades de Series de Tiempo, 1968-83, PARAGUAY.-
Consumo Per Capita de Yuca Fresca

	Yuca Fresca		Carne de Aves
Precio Propio	-0.10 (4.62)	Precio Propio	-0.33 (6.39)
Ingreso	-0.13 (7.03)	Ingreso	0.59 (10.73)
Urbanizacion	-0.13 (5.52)		
Precio Trigo	0.07 (5.38)	Precio Vacuno	-0.15 (3.10)
Precio Arroz	NO (2.78)	Precio Cerdos	0.53 (6.49)

TABLE 14

	Per Capita Consumption, Kg./year.				Relative Prices Retail	
	Beef	Pork	Poultry	Total Meat	Beef to Poultry	Pork to Poultry
1,966	49.4	16.7	3.2	69.3	1.62	1.04
1,967	45.0	17.4	3.3	65.7	1.69	1.04
1,968	46.4	17.8	3.2	67.3	1.80	1.03
1,969	44.1	18.1	3.0	65.3	1.68	0.99
1,970	45.6	18.5	3.0	67.1	1.73	0.96
1,971	42.8	18.8	3.1	64.7	1.60	0.92
1,972	38.1	19.2	3.2	60.5	1.89	1.12
1,973	31.3	19.5	4.0	54.7	1.99	1.16
1,974	33.2	19.8	4.0	57.0	1.62	1.09
1,975	28.8	20.4	3.9	53.2	1.76	1.25
1,976	27.7	21.2	3.9	52.8	1.99	1.32
1,977	30.7	21.6	4.0	56.3	1.23	0.83
1,978	27.8	22.8	4.2	54.9	1.39	0.88
1,979	32.2	25.2	4.4	61.9	1.78	1.12
1,980	31.6	25.6	4.6	61.8	1.93	1.21
1,981	29.9	25.3	4.6	59.9	1.90	1.19
1,982	28.7	24.9	4.7	58.3	1.56	1.14
1,983	28.9	25.2	4.6			

TABLE 14A

PARAGUAY -

Segregacion de fuentes de costo directo en produccion de Yuca Fresca.

Costos Totales	Costos/ton fresca	Equ. por ton. Yuca Seca 2.5 Conversion
Land 18,000	\$1,295	\$3,237 Land
Labor 67,400	\$4,849	\$12,122 Labor
Capital 29,015	\$2,087	\$5,218 Capital
Total 114,415	\$8,231	\$20,578 Total

Segregacion de fuentes de costo directo en produccion de Yuca Seca.-

	Costo/ton Secado	Costo/ton. Total Seca
Land	\$16	\$3,253
Labor	\$3,108	\$15,230
Capital	\$8,705	\$13,923
Total	\$11,828	\$32,406
Sale Price, 75% Price of Corn		\$56,000
Gross Margin per Ton of Dried Cassava		\$23,594
Yield of Fresh Cassava	13,900	

Segregacion de fuentes de costo directo en produccion de Maiz.-
Tecnologia: Arado con Buey, Manual.

Source of Direct Cost	Total	Cost/ton.
Land	\$9,000	\$3,600
Labor	\$28,925	\$11,570
Capital	\$40,100	\$16,040
Total	\$78,025	\$31,210
Sale Price, Guaranis / ton.		\$70,000
Gross Margin per Ton of Corn		\$38,790
Yield of Corn, tons/ha	2.5	

Table 15. Projections of Fresh Cassava Needs, Year 2,000,
Paraguay.

FRESH CASSAVA

Per Capita Consumption of Cassava	1983	271.9 kilos
Population 1983	3.5	
Annual Population Growth	3.0	
Population 2,000	5.7	
% Human Consumption in Total	37.7%	
Cassava Production	2,505	
Annual Growth in Real Price of Cassava	-1.0%	
Annual Growth in Real Price of Wheat	-1.0%	
Annual Growth Per Capita Real Income	1.5%	
Per Capita Consumption of Cassava 2,000		242.8 kilos
Cassava Production	3,727	
Yields/Ha	13.9	
Hectares 1983 (1000)	182.4	
Additional Hectares (1000)	78.8	
Labor per Ha (SEAG)	67	
New Jobs Generated per Year	21,122	

APPENDIX
TABLES

From: World Bank
Agricultural Sector Study

PARAGUAY

ESTUDIO SOBRE EL SECTOR AGROPECUARIO

Coefficientes de Protección Nominal: Algodón
(G/kg)

Year	Producer Price	Marketing and Processing Costs	Equivalent Border Price at Ginnery	NPC
1975	27	13.5	54	0.68
1976	44	22.0	73	0.86
1977	46	23.0	66	1.07
1978	43	21.5	66	0.97
1979	49	24.5	71	1.05
1980	59	29.5	90	0.98
1981	54	27.0	94	0.81
1982	47	23.5	87	0.74
1983	65	32.5	114	0.80

Note: Exchange rates used are G 126 to US\$1 up to 1980, G 146 for 1981, G 160 for 1982 and G 177 for 1983. One kg of algodon en rama is equivalent to 0.35 kg of lint.

Source: MAG

PARAGUAY

ESTUDIO SOBRE EL SECTOR AGROPECUARIO

Coefficientes de Protección Nominal: Soya
(G/kg)

Year	Producer Price	Marketing and Transport Costs	Equivalent Border Price	NPC
1975	18	5.4	25	0.92
1976	20	6.0	26	1.00
1977	21	6.3	32	0.82
1978	21	6.3	30	0.89
1979	24	7.2	34	0.90
1980	19	5.7	34	0.67
1981	28	8.4	33	1.14
1982	24	7.2	35	0.86
1983	30	9.0	44	0.86

Source: MAG

PARAGUAY

ESTUDIO SOBRE EL SECTOR AGROPECUARIO

Coefficientes de Protección Nominal: Tabaco
(G/kg)

Year	Producer Price	Marketing and Processing Costs	Equivalent Border Price	NPC
1975	68	58	120	1.10
1976	50	43	111	.74
1977	70	60	132	.97
1978	80	68	133	1.23
1979	120	102	169	1.79
1980	140	119	183	2.18
1981	86	73	211	.62
1982	120	102	217	1.04

Source: MAG

PARAGUAY

ESTUDIO SOBRE EL SECTOR AGROPECUARIO

Coefficientes de Protección Nominal: Carne Vacuna
(G/kg)

Year	Producer Price	Marketing and Processing Costs	Equivalent Border Price	NPC
1975	44	18	59	1.07
1976	42	17	70	0.79
1977	47	19	67	0.98
1978	51	20	95	0.68
1979	76	30	128	0.78
1980	104	42	122	1.30
1981	110	44	125	1.36
1982	85	34	120	0.99
1983	100	40	153	0.89

Note: Coefficient used to convert liveweight to boneless is 0,40.

Source: MAG

PARAGUAY

ESTUDIO SOBRE EL SECTOR AGROPECUARIO

Coefficientes de Protección Nominal: Trigo
(G/kg)

Year	Producer Price	Marketing and Transport Costs	Equivalent Border Price	NPC
1975	25	2.5	22	1.28
1976	25	2.5	18	1.61
1977	22	2.2	14	1.86
1978	22	2.2	16	1.59
1979	24	2.4	21	1.29
1980	25	2.5	23	1.22
1981	26	2.6	27	1.07
1982	35	3.5	23	1.80
1983	42	4.2	23.3	2.20

Source: MAG

PARAGUAYESTUDIO SOBRE EL SECTOR AGROPECUARIOCoeficientes de Protección Efectivos

Year	Soybeans	Wheat
1975	.85	1.20
1976	.92	1.50
1977	.73	1.60
1978	.80	1.30
1979	.81	1.00
1980	.60	1.25
1981	1.00	.90
1982	.78	1.60
1983	.85	1.90

PARAGUAY

ESTUDIO SOBRE EL SECTOR AGROPECUARIO

Costo de los Recursos Internos (1982-83)

Item	Domestic Inputs	Value of Output (\$)	Border Prices of Imported Inputs	DRC Coefficient
<u>Cotton</u>				
Traditional	46,792	615	38	.50
Improved	55,040	820	49	.44
<u>Maize</u>				
By hand	22,146	214	27	.74
Mechanized	19,818	380	95	.43
<u>Tobacco</u>				
Black	101,412	969	49	.68
Burley	109,220	1,006	74	.73
<u>Soybeans</u>				
By hand	32,091	371	45	.61
Oxen	33,075	391	59	.62
Tractor own	16,670	495	135	.29
Tractor contracted	18,688	474	158	.37
<u>Wheat /a</u>				
Own	20,640	270	167	1.25
Contract	22,554	245	190	2.55
<u>Sunflower</u>				
By hand	27,732	225	27	.86
Oxen	28,416	243	39	.87
<u>Castor Bean</u>				
Average year 1-4	25,995	426	40	.42
<u>Patit Grain</u>	60,120	414	38	1.0
<u>Rice</u>				
Dry improved	21,530	400	168	.58
Irr. mechanized	39,115	1,000	331	.37
<u>Beef</u>				
Model 1	994	19.5	7	.50
Model 2	1,758	62.5	11	0.21

/a Value of output in border price as calculated for NPC G 23.

Notes: Domestic inputs valued at market prices.
Value of output in \$ at G 160 : 1989.
Price imported inputs - at reported prices.

Source: Table 7.

REFERENCES

Paraguay

1. Baer, W.; Birch, M. "La Posición Económica Externa del Paraguay". In: CPES, ed. 1984.
2. Brun, J.; A. López.; A. Román; C. Caballero. "Proyecto de Generación y Validación de Tecnologías. Industrialización de la Mandioca". MAG/SEAG, San Lorenzo, Paraguay, 1985.
3. Carter, Simon. "Cassava Micro-regions in Part of Eastern Paraguay". CIAT, Colombia, 1986.
4. Centro Paraguayo de Estudios Sociológicos (CPES) Editors. "Economía del Paraguay Contemporáneo". 2 Vols. Asunción, 1984.
5. Fletschner, Carlos. "La Realidad Socioeconómica del Sector Agropecuario". In: CPES editors, 1984.
6. Franco, J.D. "Evolución y Perspectiva de la Exportación (Estrategias y Políticas)". In CPES editors, 1984.
7. Ground, R.L. "El Auge y Recesión de la Economía Paraguaya, 1972-1983. El Papel de la Política Económica Interna". In: CPES editors, 1984.
8. Lynam, J.K.; D.P. Pachico. "Cassava in Latin America: Current Status and Future Prospects". Unpublished. CIAT, 1982.
9. MAG - División de Comercialización y Economía Agropecuaria. "Evolución de la Oferta y Demanda de Productos Agropecuarios: Trigo, Arroz, Maíz, 1968-1987". Asunción, Diciembre 1985.
10. MAG and IICA. "Informe Sobre el Panel Cultivo de Maíz en el Sudeste del Paraguay". Obligado, 1985.
11. MAG/SEAG. "Diagnóstico de la Situación Alimentaria y Nutricional de Familias de Socios del Proyecto de Tecnología para Pequeños Agricultores". Asunción, 1982.
12. MAG/SEAG. "Análisis y Planificación de la Mano de Obra Familiar". San Lorenzo, 1984.
13. MAG/SEAG. "Informaciones Básicas sobre la Mandioca en Paraguay". San Lorenzo, 1985.

14. Presidencia de la República, Secretaría Técnica de Planificación. "Plan Nacional de Desarrollo Económico y Social, 1985-1989". Asunción, Noviembre 1985.
15. Rodríguez, S.R. "Paraguay, Dependencia EStructural y Comercio Exterior". In: CPES editors, 1984.
16. World Bank. "Paraguay, Estudio sobre el Sector Agropecuario". 2 Volumes (Confidential Report). Washington, D.C., 1984.

EL POTENCIAL DE LA YUCA EN MEXICO
Y SUS RELACIONES CON EL RESTO
DE LA ECONOMIA

Dr. Roberto R. Saez
CIAT - Programa Yuca Economía
Diciembre, 1986

Cassava Potential in Mexico and Its Relationship with the Rest of the Economy

Roberto R. Saez
20 January, 1987

Summary and Conclusions

Although Mexico has achieved significant and continuous economic growth since the early fifties, its economy stopped expanding for the first time in 1982, entering a severe recession during 1983-84, while just barely recovering those losses by 1985, to arrive at equivalent 1981 production levels. Throughout these decades several policy distortions were slowly but consistently developing (i.e., in the areas of fiscal, monetary, and exchange rates policies) which moved the country into an unprecedented inflationary process, significant disequilibrium in its trade and current account balances (that led to the accumulation of the second largest LDC foreign debt), and major reductions in purchasing power in the salary for the average worker. Nevertheless, due to policy revisions Mexico appears to be starting to build bases for a healthier economic growth. Trade and current account surpluses in recent years are apparent, as well as a trend to reduce fiscal deficits, conduct a neutral monetary policy, and reach more favorable terms for its foreign debt repayment.

The agricultural sector, in particular, has been expanding at a slower rate relative to the other productive sectors, which implies that typical rural per capita incomes are below the national average, even though significant labor emigration towards urban areas and abroad has been under

way. The reason for that is the increasing difficulties in expanding total cropping land available, and thus further production and income growth has had to depend on productivity gains. Moreover, beef cattle performance is constrained by the predominance of extensive production systems, and the existence of legislation that does not properly encourage investments badly needed for higher productivity gains. Another crucial indicator of the unsatisfactory growth of the Mexican primary sector is the shift that took place in the agricultural trade balance during the last few years, which between 1980-83 showed an average US\$1,000 million deficit per year. Commodities which account for the above trade deficits are the strong external dependence on maize, grain sorghum, and dairy products.

Mexico's protein per capita consumption from animal origin is still below the levels of other countries in comparable stages of development. Although good progress has been attained in domestic supply of broilers, pork, and eggs, more should be expected in all of these, in addition to the relatively slow improvement in dairy and beef consumption. Whenever the country resumes its past economic growth, new and stronger pressures will be evident in domestic feed grain demand (i.e., grain sorghum) to increase productivity within the livestock sector.

Cassava production in Mexico has all the potential to provide a positive contribution to several of the deficiencies just cited, that is: (a) its lower soil fertility requirements makes feasible the expansion of the agricultural frontier utilizing this crop, (b) its efficient utilization as an energy source in animal feed formulations can clearly reduce the need to import grain sorghum, and (c) its high labor

requirements in production and processing generates sources of income in poor rural areas with few additional alternatives.

In order to develop an appropriate strategy to meet these objectives, an economic analysis was conducted to evaluate cassava private profitability. The analysis of root production costs in relation to root prices showed a net return of 10 per cent a year on total fixed capital requirements (i.e., land and processing plants); the price of dried cassava offered at the animal feed plants being 80 per cent of the price of sorghum. The prerequisites to arrive at that economic performance are average fresh cassava yields of 15 metric tons/ha, and each concrete floor of 2,000 square meters being able to generate 460 metric tons of dried chips during a six month period. Cassava roots for conversion into silage showed even higher profitability levels, due to a shortening of 5-6 months in the length of the production cycle relative to dried cassava (the reason is not a biological one but due to a better harvesting time). Recent policy changes will also favor cassava production indirectly. The creation of sorghum price differentials between different consumption regions have reduced internal transportation subsidies. Also allowing any private firm to import sorghum, will force domestic prices more in line with international prices. Previously domestic prices have been below international prices. Flexible exchange rate adjustments can also help in the same direction.

Although private internal prices for dried cassava are comparable to international ones (US\$97.00/ton cif Mexico), when input prices are costed at social prices an effective protection coefficient of 1.43 is derived.

The existence of government subsidies in the cost of agricultural machinery services supplied by the state, as well as in fertilizers and fuel explain the fact that cassava social costs are higher than those observed by farmers. Furthermore, a DRC coefficient of 1.08 was computed for production-processing-marketing of dried cassava, so that the social cost for fixed factors of production (i.e., labor, capital, and land) are above the value-added for dried cassava also evaluated at shadow prices. Minor increases in the international price for cassava (grain sorghum), and/or in the social internal transportation costs to ship the product to consumption areas, and/or small reductions in the social cost of labor (including income distribution considerations) can easily change the above DRC result into a figure less than one.

The estimated demand potential for dried cassava at the national level in 1990 indicates a need to generate an annual production of 1,336,000 tons of cassava root, which allows the substitution of 1,491,000 tons of imported sorghum, and net positive savings in foreign exchange in the range of US\$114.2 million per year (the increased purchases of soybean meal from abroad in order to keep a constant protein balance in the animal feed ration are taken into consideration). It would be necessary to plant 231,570 has of cassava by 1990 allowing the creation of 61,500 year-round jobs in marginal areas. It is expected that swine should demand nearly half of the cassava supplied, followed by dairy cattle, and poultry. Finally, improved transportation methods for dried cassava (i.e., pelletization) should be gradually implemented to better compete with domestic sorghum in areas located at a distance from tropical production zones.

EL POTENCIAL DE LA YUCA EN MEXICO Y SUS RELACIONES CON EL RESTO DE LA ECONOMIA

Resumen y Conclusiones

A pesar de que México lograra un crecimiento económico muy significativo y continuo desde la década de los '50, la economía se detuvo por primera vez en 1982, entrando en una severa recesión en 1983 y 1984, para recién en 1985 recuperar el terreno perdido y arribar a los niveles productivos de 1981. Durante todos esos años se fueron generando ciertos desvíos de política económica (en las áreas fiscales, monetarias y cambiarias) que condujeron al país a un proceso inflacionario sin precedentes, severos déficits en la balanza comercial y de pagos, gran endeudamiento externo, así como pérdidas en el poder adquisitivo del salario del trabajador medio. Sin embargo, fruto de revisiones de política en años recientes, se estarían echando las bases para un crecimiento más sano al empezar a verificarse superávits comerciales y en la cuenta corriente de la Balanza de Pagos, tendencias a la reducción del déficit presupuestal de Gobierno, practicar una política monetaria neutra en el circulante, y alcanzar una renegociación más favorable de su deuda externa.

El sector agropecuario por su parte ha estado creciendo a un ritmo por debajo de los demás sectores productivos con lo que los ingresos per cápita promedio rurales, a pesar de la ocurrencia de una fuerte emigración hacia centros urbanos y/o al exterior, se encuentran muy por debajo de los sectores no-rurales. La razón de ello son los crecientes dificultades de expandir la superficie total agrícola nacional, por lo que la mayor parte de los aumentos de producción deberán ahora ser explicados mediante incrementos de productividad. Por otro lado, rubros como la ganadería de bovina de carne tienen como limitación su enfoque extensivo de producción, así como la existencia de problemas de legislación rural que no estimulan adecuadamente la inversión productiva en dicha

actividad. Otro indicador de la insuficiencia en el crecimiento del agro mexicano ha sido el viraje que tomó la balanza comercial agropecuaria en años recientes, la cual desde 1980 se ha transformado en negativa en el orden de los US\$1,000 millones anuales entre 1980 y 1983. Rubros representativos cuyos importantes déficits internos en producción explican tal fenómeno son el maíz, sorgo y productos lácteos.

Los consumos per cápita de proteína de origen animal en México se encuentran todavía por debajo de lo que manifiestan economías en estado comparables de crecimiento. A pesar de los importantes progresos en la oferta interna de productos como carne de pollo, cerdo y huevo, mucho más se puede esperar de ellos, así como también en términos de lácteos y carne de res. En la medida que el país retome el crecimiento económico que lo caracterizara durante las últimas tres décadas, nuevas y más fuertes presiones se generarán en la demanda de cereales forrajeros como el sorgo, a los efectos de dar sustento a los aumentos en productividad requeridos dentro del subsector pecuario.

El cultivo de yuca en México tiene todo el potencial para dar respuesta a varias de las deficiencias antes citadas, como son: (a) sus menores requerimientos en fertilidad de suelos, lo cual lo hace muy atractivo como para que el país pueda expandir su frontera agrícola en esta actividad, situación que seguramente no es viable en muchos de los rubros tradicionales, (b) su utilización eficiente como fuente energética en dietas animales, permitiendo aliviar las presiones de importaciones de sorgo, y (c) sus altos requerimientos de mano de obra durante sus etapas de producción-procesamiento, generando fuente de ingresos en zonas rurales con escasas alternativas adicionales.

Para dar sustento a las afirmaciones anteriores se condujo un análisis económico que verificase la rentabilidad privada de la actividad yuca. Del mismo se concluyó sobre la adecuada competitividad de esta raíz al permitir generar en moneda constante un 10% de interés anual sobre el capital fijo total invertido (ej., tierra y plantas de procesamiento), y al mismo tiempo el precio final del producto seco ofrecido y puesto en planta de alimento balanceado ser un 80% del precio

del sorgo en dicho lugar. Los requisitos esenciales para arribar a estos niveles de eficiencia económica son de que el rendimiento medio por hectárea de yuca fresca sea de 15 tons, y que cada patio de 2,000 m² de superficie sea capaz de generar en un período de seis meses la cantidad de 460 tons de producto seco. La yuca producida con miras a ser ensilada en silos apropiados muestra aún más altos niveles de rentabilidad al poderse acortar la duración de su ciclo de crecimiento en 5-6 meses. Un cambio reciente de política que debería favorecer indirectamente la producción de yuca es el de la presencia de precios diferenciales del sorgo entre las distintas zonas de consumo del cereal, el suprimirse parte de los subsidios de su transferencia a regiones lejanas a los centros de producción.

Si bien el precio interno de la yuca deshidratada es comparable al de su equivalente internacional (US\$97.0/ton métrica), cuando se toman en cuenta los insumos que se requieren para su producción se arriba a un coeficiente efectivo de protección de 1.43. La presencia de subsidios en los servicios de maquinaria agrícola aportada por el Estado, en los fertilizantes, y en los combustibles explican que el costo social de la producción-procesamiento-comercialización de yuca sea superior al costo observado por el agricultor. En adición se concluyó que el coeficiente "DRC" para esta raíz de 1.08, con lo que se verifica su ligera rentabilidad social negativa, al ser los costos sociales de los factores fijos de producción (trabajo, capital y tierra) superiores al valor agregado de la producción de yuca seca, valorada también a su precio sombra. Ligeros aumentos en los precios equivalentes internacionales de yuca, y/o en sus costos de comercialización para su introducción al país, y/o reducciones menores en el costo social de la mano de obra harían cambiar el resultado del DRC hacia el lado positivo.

Al cuantificar la demanda potencial de yuca seca a nivel nacional se concluyó de que hacia 1990 existirían las necesidades de generar anualmente 1:336,000 tons de este producto, permitiendo sustituir 1:491,000 tons de sorgo importado, y un ahorro neto positivo de divisas del orden de US\$114.2 millones anuales (al tomar en cuenta las necesidades de mayores importaciones de pasta de soya para mantener un

balance proteico constante en las dietas animales). Para tales efectos se necesitarán de la siembra de 231,570 has de yuca, las que permitirán la creación de 61,500 empleos eficientes (hombres-año) en áreas con baja productividad actual. La producción de cerdos será la que podrá consumir hasta en un 50% la yuca a ser producida, siguiendo en orden de importancia la lechería y la avicultura. Por último, deberán mejorarse los mecanismos de transporte de yuca seca mediante su peletización a efectos de eficientar su comercialización a zonas lejanas a las de producción, y así mantenerse competitivo con el sorgo.

EL POTENCIAL DE LA YUCA EN MEXICO Y SUS RELACIONES CON EL RESTO DE LA ECONOMIA

Este trabajo resume las investigaciones relativas a la economía del cultivo de yuca en México durante los dos últimos años, como parte de un proyecto del CIAT que involucrara a este autor en varios países de Meso-América. El presente documento intenta cuantificar las reales posibilidades de esta raíz en el país, verificando los incentivos privados y sociales que tiene dicha actividad como condición esencial para la generación de una oferta comercial suficiente que satisfaga la demanda potencial agregada que oportunamente fuera detectada. Durante el proceso de derivación de estos resultados fue también necesario clarificar los vínculos directos e indirectos que tiene la yuca con los demás sectores económicos, para de esta forma resaltar aún más su importancia estratégica.

A) Aspectos Macroeconómicos

La economía mexicana ha estado creciendo muy significativamente desde la década de los '50 hasta 1981, a un ritmo promedio anual de 6.7%, implicando con ello que cada 11 años su capacidad para generar bienes y servicios se duplicaba. Consistente con la afirmación anterior, el ingreso bruto per capita de México también evidenció claros progresos, al crecer a una tasa del 3.4% anual. Esta etapa de bonanza económica quedó truncada en 1982 cuando el Producto Bruto Interno (PIB) primero se detiene, para luego caer en 1983 y 1984 a valores 5.2% y 2.5% inferiores respectivamente a lo alcanzado en 1981, para recién en 1985 recuperar los niveles de 1981. A pesar de ello, el tamaño de la economía mexicana en 1985 alcanzaba el muy significativo monto de US\$181.4 billones (Apéndice 1.1).

Son varias las razones que explican la evolución económica seguida por México, por lo que se comenzará por analizar al sector público en su calidad de demandante de bienes y servicios (política fiscal). Así, al evaluar la participación relativa de los gastos corrientes del Gobierno

dentro del PIB durante las tres últimas décadas, se observa una clara tendencia a acrecentar su rol, al pasar de un 4.4% a un 11.4% en 1982. De haber existido un total equilibrio entre los ingresos y gastos públicos durante todo ese tiempo, de manera que el alcance del Gobierno se hubiera limitado a su real capacidad de generación de ingresos, aquella tendencia no hubiera sido negativa en sí. Sin embargo, al computar los niveles de déficit fiscales con relación al tamaño de la economía (PIB) en cada año, se verifica un creciente desnivel hasta llegar a un 15.7% en 1982 (7.8% en 1983). En otras palabras, durante el bienio 82/83 los ingresos solo ascendieron a un 65% del total de egresos (consumo más inversión). El déficit público acumulado entre 1966 y 1983 ascendió a US\$87 billones, los que fueron financiados en un 73% en el mercado interno de valores del país, y en un 27% mediante financiamiento externo. Este exceso de demanda agregada atribuible al desequilibrio presupuestal de México, dio las bases para que se iniciara un proceso inflacionario creciente. Periodos claramente diferenciables son: (a) 1953-1971: en donde los precios internos crecían a solo un 4.2% anual, (b) 1971-1980: a 15.9% anual, y (c) 1980-1985: a 48.5% anual (Apéndice 1.2 y 1.3).

Una directa consecuencia del desencadenamiento de todo proceso inflacionario es que el poder adquisitivo del salario tiende a decrecer. Al verificar esto con la realidad mexicana se comprueba que durante 1953-71 cuando la inflación era muy leve, el índice general de salarios subía más rápidamente que los precios. Durante toda la década de los '70 y principios de los '80, las variaciones de precios y salarios fueron aproximadamente equivalentes, hasta que desde 1983 al presente se comprueba que los salarios no se ajustan a los cambios de precios, sufriendo el trabajador medio del país una pérdida significativa en su poder de compra (un 29% entre 1982 y 1984).

Otra herramienta que cuenta en general todo gobierno es la definición de su política monetaria. Una política monetaria "neutra" es aquella que permite que el volumen de dinero circulante esté en todo momento en relación con el valor de los bienes y servicios generados por una economía. Este justamente fue el caso en México durante el periodo

1953-75, en donde mientras el PIB se movilizaba a un ritmo del 6.6% anual, la cantidad de dinero circulante real aumentaba a un 6.0%. Sin embargo, esta política se interrumpe en la segunda mitad de los '70 y se prolonga hasta 1982 cuando la masa monetaria real ampliamente supera al crecimiento del PIB (15.9% vs 5.2%). Ello nos conduce a pensar que parte de los déficits presupuestales generados durante este período, fueron en realidad financiados por una emisión monetaria sin ningún respaldo económico. Esta política monetaria "expansionista", si bien le reduce la presión al gobierno en cuanto a dar cumplimiento con el servicio de su deuda interna contraída, lógicamente prepara las bases para una acentuación de los problemas inflacionarios. Eventualmente el Gobierno de México fue conciente de ello, por lo que hacia 1983, 1984 y 1985 la masa de dinero real circulando decrece más fuertemente que la caída del PIB, buscando conseguir una contracción monetaria que aliviase las presiones alcistas de los precios. Sin embargo, ello no tuvo los resultados esperados al ser ya muy fuertes las expectativas inflacionarias del productor/consumidor del país (Apéndice 1.4).

Otro rol muy importante que tiene el sector público es la definición de su política cambiaria. Casi sin excepción toda economía que busque y desee ampliar sus relaciones internacionales, su tipo de cambio debe estar en directa relación con la evolución diferencial de los precios internos entre las principales economías que comercialicen entre sí (ej., EEUU y México). En este sentido es posible observar que durante dos décadas (1955-1975), el tipo de cambio de México estuvo congelado en los Mex\$12.50 por dolar americano, durante un período en que si bien el ritmo inflacionario interno era leve, a pesar de ello era superior al correspondiente a EEUU. Así, mientras los precios promedios en este último país se duplicaban en dicho período, en México los mismos se triplicaban. Durante los años 1976/77 las presiones internas para fijar un tipo de cambio más realista fueron muy fuertes, por lo que el gobierno decidió devaluar su moneda, primero a \$15.43 (1976), y luego a \$22.57 (1977). Sin embargo, nuevamente predominó un criterio "nacionalista" hacia la defensa de la moneda mexicana, por lo que las subsecuentes correcciones cambiarias se hacen muy lentamente, arribándose hacia 1981 a un valor del dolar de \$24.52, a pesar de que por entonces ya se

había desatado un proceso inflacionario bastante significativo. No es sino hasta 1982 en donde el ajuste cambiario se hace inevitablemente más flexible, con lo que la tasa de devaluación promedio anual entre 1981 y 1985 se sitúa en el 60%. En adición, el diferencial entre el dólar controlado (aquel que sirve para efectuar las transacciones internacionales más esenciales), y el dólar libre (fruto del equilibrio de oferta y demanda por esta divisa en el mercado interno), se ubica a niveles bastantes similares entre sí durante 1983-85 (0.844), lo cual implica un precio oficial relativamente adecuado por este recurso escaso.

Naturalmente que las repercusiones de una política cambiaria van mucho más allá de una simple posición nacionalista. En gran medida ella condiciona el éxito (fracaso) de la política comercial de un país en su calidad de demanda de bienes y servicios del exterior, y de su capacidad de ofrecer sus propios productos a precios y calidades competitivas. Un tipo de cambio sobrevalorado como el que predominara en México por muchos años, tiene como consecuencia que las importaciones tenderán a ser relativamente baratas por lo que se estimularán, en contraposición con el hecho de que las exportaciones serán relativamente menos competitivas en el exterior, y/o los empresarios nacionales no tendrán los suficientes incentivos para su promoción y crecimiento.

Estudiando la balanza comercial de México durante las tres últimas décadas (total de bienes exportados menos bienes importados), se puede verificar en gran medida las afirmaciones generales del párrafo anterior. Así tenemos que entre 1953 y 1969 el déficit comercial representaba en promedio un 45% del volumen exportado, desequilibrios éstos que continuaron acentuándose con el paso del tiempo a 75.4% de lo exportado en 1970 y 126.3% hacia 1975. Como consecuencia de la aparición de un nuevo y muy importante producto exportable (petróleo), la economía mexicana comienza a reducir lentamente sus déficits comerciales, pero no será sino hasta 1982 en donde por primera vez logra un superávit de US\$6.8 billones. Desde 1982 hasta 1985 el país en su conjunto fue capaz de exportar US\$1.88 por dólar importado. Consecuentemente, el cambio positivo experimentado en el comportamiento comercial de México desde 1982 puede atribuirse en parte a un proceso

acentuado de devaluaciones, así como a un control estricto de importaciones (ej., 1982 se importó 40% menos que en 1981, y durante 1983, 64% menos que en 1981), y posiblemente también a una caída en la demanda total agregada del país (Apéndice 1.5).

Llama la atención el hecho de que los saldos positivos comerciales de México entre 1982 y 1985 neutralizaron completamente todos los déficits comerciales acumulados desde 1953, quedando aún así un superávit de US\$11,905 millones. Sin embargo, la recuperación financiera por esta vía es solo parcial, ya que se debe adicionar los demás movimientos financieros (transacciones) entre países (ej., flujo neto de servicios, servicio de la deuda externa, turismo, remisiones al exterior por otros conceptos, etc), con lo que el saldo acumulado de la cuenta corriente de la Balanza de Pagos se situaba en 1985 con un negativo de -US\$48,176 millones ^{1/}. Esta última cifra es la que realmente está pesando sobre la economía mexicana, y a la que se intenta renegociar con plazos más amplios y menores tasas de interés, a efectos de que el servicio de la misma no ahogue la capacidad efectiva de crecimiento del país. Quizás como un indicio estimulante hacia el futuro, entre 1983 y 1985 se consiguieron saldos positivos en la Cuenta Corriente, los que no se habían generado desde 1955, por un monto acumulado de US\$10,199 millones (Apéndice 1.6).

Resumiendo, si bien México ha mostrado una gran capacidad de crecimiento económico sostenido durante muchos años, el propio éxito alcanzado fue enmascarando algunas importantes distorsiones de sus políticas fiscales, monetarias y cambiarias que indujeron por un lado, a la generación de un proceso inflacionario sin precedentes durante los '80, pérdidas significativas en el poder adquisitivo del trabajador, y severos déficits en la balanza comercial y de pagos. Con el advenimiento de la presente administración política del país, se empezaron a tomar medidas correctivas a los desvíos pasados, especialmente con el objetivo de reducir los déficits fiscales [racionalizando el gasto público

^{1/} Si a esta cifra se le agrega otras deudas contraídas por el Estado y los particulares, se arriba a una deuda externa hacia fines de 1985 de US\$86,504.3 millones (BANAMEX, 1985).

(incluido la eliminación o reducción de subsidios y venta de paraestatales)], ajustar la masa monetaria al volumen real de la economía, y ejecutar una política cambiaria realista que estimule la obtención de balances netos positivos de divisas. La caída reciente en los precios del petróleo lógicamente ha complicado las ya difíciles metas a concretar, pero aún así habría indicios de que México está arribando a un nuevo equilibrio que le permitirá retomar un crecimiento más sano de su economía en los próximos años.

B) El Sector Agropecuario de México

El sector primario de la economía mexicana ha venido perdiendo terreno en su participación dentro del PIB total, situación ésta que es muy característica de economías que han estado sometidas a rápidos procesos industriales, y en donde a su vez, el sector terciario (gobierno y sector servicios) ha crecido más que proporcionalmente. Así tenemos que mientras el PIB agropecuario (sumatoria de la contribución de los subsectores agrícola, pecuario, forestal, y pesquero) se situaba en 1960 en un 15.9% del total, su ponderación ha venido cayendo sistemáticamente hasta 1982 (con 7.4%), para luego recuperarse levemente hacia 1984 con 9.4% de participación. Lógicamente que este deslizamiento de los aportes relativos del agro mexicano ha estado directamente relacionado con un proceso de movilización de recursos humanos hacia las ciudades. Dichos movimientos migratorios internos fueron bastante significativo entre 1965-1973 (4.8% anual), decreciendo algo en años más recientes (1973-84: 4.0% anual) (Banco Mundial). Computando entonces el PIB agropecuario en relación a la población rural de 1984 (la que se estimaba en un 31% del total poblacional), se arriba a una cifra promedio de US\$620 per cápita anuales, los que contrastan abiertamente con el valor del producto generado por los sectores no agropecuarios en relación a su respectiva población (US\$2,954 per cápita anual). Al margen de algún tipo de distorsión que incida en el cómputo de estos dos niveles de ingresos, el diferencial entre ellos es más que significativo como para reconocer las desigualdades de oportunidades de progreso y bienestar entre estos grupos sociales (Apéndice 2.1).

El sector primario de México ha estado creciendo entre 1960 y 1985 a una tasa anual del 3.55%, la que fue significativamente inferior al 5.5% de la media de toda la economía. La década de los '70 fue en donde el agro aumentó más rápidamente sus niveles de producción (3.65% anual), los que fueron superiores a los de la década de los '60 (2.88% anual), y a los de los '80 (3.41% anual).

Analizando la composición del PIB agropecuario, se puede comprobar que es el subsector agrícola el que tiene un rol mayoritario con 58.4% en 1985, a pesar de que la superficie efectivamente utilizada por el mismo es de apenas un 12% del territorio nacional (ej., área cosechada en 1983: 20:808,462 has). Esta área cultivada se lleva a cabo en un 75% bajo condiciones de temporal (secano), y en un 25% bajo riego (ej., 4:845,235 has en 1983). En segundo lugar se ubica el sector pecuario con una participación del 34.8% en 1985. Sin embargo, la tasa de crecimiento de este último subsector ha estado consistentemente por encima del agrícola entre 1960 y 1980 (4.8% vs 3.6% anual), especialmente durante los '70, fruto de la expansión de los rubros avícolas y porcícolas. Por lo contrario, en lo que va de los '80 la demanda por productos de origen animal se ha venido resintiendo, con lo que sus respectivas ofertas crecieron más débilmente que la de los cultivos. Un desglose del subsector pecuario de México en 1983 nos ilustra de la siguiente distribución: (a) cerdos: 31.6%, (b) lechería: 22.5%, (c) ganadería de carne: 22.4%, (d) pollos de engorda: 10.8%, (e) huevo 8.0%, y (f) otros: 4.7% (Saez, 1985).

Otro punto importante que sirve para caracterizar al agro mexicano es su balanza comercial internacional, así como su aporte a las importaciones y exportaciones totales. Así tenemos que entre 1969 y 1983, mientras las importaciones de origen agropecuario representaban un 13.0% del total importado (con lo que se asemeja bastante a su participación dentro del PIB total), las exportaciones de productos primarios ponderaban en un 31.9% del total exportado. En adición, existe una clara distinción entre ellas, pues mientras las importaciones han estado fluctuando en términos de su respectiva media, el porcentaje de productos exportados agropecuarios han tendido a la baja sistemática-

mente, situándose en 1983 con solamente un 7.3% (Apéndice 2.2).

Más importante aún es lo que ha ocurrido con el balance neto de divisas aportadas por el sector primario. En este sentido es posible comprobar que mientras se consiguieron saldos netos favorables entre 1969 y 1979 del orden de los US\$487.7 millones por año en promedio, durante los cuatro últimos años reportados (1980-83) se generaron muy importantes déficits: US\$1,088 millones por año en promedio. La razón de ello se deberá encontrar en la disminución del crecimiento que experimentara el sector primario, el cual ha estado por debajo de el de su población durante años recientes, con lo que por un lado los excedentes exportables se han contraído, y por otro las disponibilidades internas de los demás bienes también se han reducido. Productos particularmente deficitarios en la balanza comercial han sido los cereales (1982-84: -US\$804.8 millones anuales), semillas oleaginosas (1978-83: -US\$304.4 millones anuales), y productos lácteos (1979-84: -US\$130.5 millones anuales). Incluso llama la atención que el saldo neto de exportaciones de carne de res entre 1978 y 1983 fuera de apenas US\$65.9 millones anuales en promedio, a pesar de que a esta actividad se le dedica un alto porcentaje del territorio nacional. Saldos positivos significativos se generaron solamente en los rubros de frutas y vegetales (ej., tomate), café y cacao (1979-83: subtotal agregado anual: US\$754.9 millones) (FAO, 1984).

1) Maíz y Sorgo

De entre la gran cantidad de cultivos que se practican en México, son el maíz y el sorgo los que por su importancia y cuantía los que más directamente están relacionados con la problemática de la yuca en este país. Consecuentemente se hará una breve discusión sobre sus respectivos comportamientos históricos, para luego vincularlos entre sí y con respecto a la yuca.

Comenzando por el maíz, es indiscutible su enorme gravitación dentro de la economía agropecuaria mexicana el explicar este cultivo en 1983 un 36% del total de superficie cosechada, y ocupar un área de 7.4

millones de has. Prácticamente durante las últimas dos décadas no ha habido aumentos en área, aunque sí en los rendimientos unitarios (entre 1964-85: 2.3% de crecimiento anual). Combinando los efectos de áreas trabajadas y de eficiencias productivas se tiene que la producción pasó de 3.7 millones de tons en 1953 a 14.0 millones de tons en 1985 (crecimiento: 4.1% anual)(Apéndice 2.3).

Durante el período 1953-72, cuando la producción interna de maíz creció a un ritmo del 4.6% anual, México estaba en condiciones de exportar pequeños excedentes de este grano en el orden del 2% de su producción total en promedio. Sin embargo, entre 1972 y 1985 el crecimiento de la producción cae a un 3.04% anual, explicado en un 92% por aumento en los rendimientos, con lo que se evidencia las dificultades que enfrenta este cultivo para continuar indefinidamente la expansión en área. Como directa consecuencia de lo anterior, y de los continuos aumentos de población y de los consumos per cápita de este grano, ello condujo a que el país se viera obligado a importar un promedio de 2.0 millones de tons anuales entre 1973-85, ó 2.7 millones de tons entre 1980-85.

Evaluando el estímulo económico que recibiera el productor maicero de México durante las últimas tres décadas, se puede apreciar que la relación de precios internos con respecto a los precios fob de EEUU (Golfo) fue de 1.31 entre 1957 y 1985. Si agregamos a los precios fob de maíz, el costo de su movilización hasta la frontera mexicana (posiblemente un 5%), para luego añadir los costos de su distribución por todo el país, se podría argumentar que los precios internos se encontraron históricamente a niveles aproximadamente competitivos a los correspondientes internacionales. La excepción quizás sean los últimos seis años (1980-85) en donde presionado el Gobierno por decrecer los déficits internos de este cereal, los precios medios rurales se situaron a un 1.56 de los precios fob, a pesar de lo cual las deficiencias en la producción nacional siguieron incrementándose.

Por su parte, el historial del sorgo en México es bastante más reciente, encontrándose hacia 1985 con una superficie cosechada de 1.9

millones de has. Entre 1958 y 1985 su producción aumentó a un ritmo del 14.4% anual, explicado en un 72% por crecimiento en área. Hasta 1973 no existieron mayores problemas por abastecer las necesidades internas mediante producción nacional. Sin embargo, de 1973 a 1985 la producción ya solo podía crecer a un 5.7% anual puesto que se encontraron las mismas dificultades que el maíz tuviera por expandir el área bajo cultivo (a pesar de ello, el área en sorgo seguía creciendo al 3.7% anual). Simultáneamente la demanda interna por este grano se expande a un ritmo muy vigoroso (1973-85: 7.4% anual), por el empuje que estaban tomando varios rubros pecuarios, todo lo cual determinaba la necesidad de importaciones crecientes (prom. 1974-84: 1.6 millones tons anuales; prom. 1980-84: 2.7 millones de tons anuales) (Apéndice 2.4).

Esta importante expansión de la producción de sorgo en México se logró a pesar de que su precio relativo respecto al del maíz se situaba a solo 71.6% entre 1958-85, en contraposición con lo que ocurría en los mercados internacionales entre estos dos cereales, y/o a nivel de los precios internos en EEUU (promedio: 90-93%). Tomando en cuenta lo que se argumentara del precio competitivo interno del maíz en México, se deduce que el productor sorguero fue penalizado en el mismo en el orden de un 20%.

Lógicamente que las razones últimas de esta política han tenido que ver con el carácter tan especial que tiene el maíz en la idiosincracia del pueblo mexicano, así como también la preocupación del gobierno federal de suministrar sorgo lo más barato posible al subsector pecuario para que con ello se provoquen menores presiones alcistas en los precios de las proteínas de origen animal, "protegiendo" de esta manera el poder adquisitivo del consumidor urbano. Otro argumento esgrimido es que dado el otorgamiento de algunos subsidios a la producción del sorgo (ej., en el precio de los fertilizantes, diesel, agua para riego, etc.) no sería necesaria la concesión de todo el precio internacional al productor. Con todo, este último motivo se desmorona al notar que estos subsidios no son exclusivos del sorgo y además, que tan importante como el precio absoluto de un producto es su precio relativo frente a otros rubros competitivos.

Sin embargo, de haberse corregido el diferencial entre estos granos a efectos de hacerlos consistentes con los niveles internacionales, seguramente ello hubiera estimulado una mayor producción de sorgo nacional a expensas de un menor volumen de maíz generado. A su vez, es importante enfatizar de que sin llegar a ser excepcionales los rendimientos de sorgo en México, éstos en promedio más que duplican a los del maíz durante todo el período bajo estudio. Teniendo en cuenta que sus costos de producción deben ser muy similares entre sí (si no mayores para el maíz), es posible argumentar que el Gobierno de México no ha estado acertado en su política de precio al sorgo, ya que el valor de la producción adicional de este último en condiciones de mejores precios hubiera más que compensado las pérdidas en valor del maíz dejado de producir. Adicionalmente, un mayor precio interno del sorgo incrementaría las oportunidades de sustituir eficientemente al sorgo por yuca deshidratada, con lo que el efecto neto final de esta corrección de política se acentuaría aún más.

Un 36% de la superficie cultivada de sorgo es realizada en condiciones de riego, explicando esta superficie un 45% de la producción total. Con todo, los avances en mejoramiento de rendimientos han sido más significativos bajo condiciones de temporal (prom. 1960-85: 2.85% anual), que en riego (prom: 1.86%), por lo que el diferencial de eficiencias físicas que se situaba en 76% en 1960, se reduce a 37% hacia 1985 (Apéndice 2.5).

A diferencia del maíz, la producción de sorgo se encuentra concentrada territorialmente en el país, ya que 86.4% de la producción en 1985 era explicada por el aporte de cinco de las 32 entidades federativas (ej., Tamaulipas, Guanajuato, Jalisco, Michoacán, y Sinaloa). Del total de la producción nacional de ese año, la paraestatal CONASUPO adquirió un 22.8%, con el resto comercializado entre particulares. Sin embargo, como hasta 1985 CONASUPO era la única institución autorizada en importar sorgo, su capacidad de oferta interna se elevó a un 45% del total. En 1986 las empresas que así lo deseen

podrán importar el sorgo que necesiten; CONASUPO por su parte seguirá importando fundamentalmente para satisfacer los requerimientos de la pequeña empresa (Apéndice 2.6 y 2.7).

Finalmente, otro acontecimiento reciente muy significativo ha sido que desde el último trimestre de 1984 se dividió al país en tres grandes regiones, con miras a que el precio del sorgo sea diferente entre ellas en función de los costos en que se incurre para su transporte. De esta forma se deroga el precio único que regía por este cereal en todo el territorio nacional. En 1985 se aumentó a cinco las regiones para estos efectos, fijándose en un 21% el diferencial de precios entre la zona con menor precio (Tamaulipas) a la de mayor precio (Península de Yucatán) a nivel de consumidor de sorgo. Para 1986, dicho diferencial se redujo a 15%. De esta manera se crean mejores circunstancias económicas que dan nuevas oportunidades de competencia entre diversos rubros en las diferentes regiones, así como se eliminan importantes subsidios federales requeridos para ejecutar aquel programa de precios únicos.

2) Sub-Sector Pecuario.

Si bien el promedio agregado del subsector pecuario evolucionó a niveles comparables con el del subsector agrícola, particularmente durante la última década es posible cuantificar importantes diferencias entre sus componentes pues mientras la producción de pollos, cerdos y huevo crecían a tasas muy significativas (ej., 7.96%, 7.34% anual (1972-84), y 6.43% (77-84), respectivamente), los rubros de carne de res y lechería apenas si avanzaban lo suficiente como para mantener la misma disponibilidad de producto por habitante (ej., 3.06% y 2.7% (1972-83), respectivamente) (Unión Nacional de Avicultores, 1985, y SARH, 1984) (Apéndice 2.8).

Con todo, a pesar de los importantes progresos alcanzados por México en algunos de los rubros pecuarios, sus respectivos niveles de consumos promedios en años recientes se sitúan todavía a valores bajos comparativamente a los obtenidos en países latinoamericanos, y con más razón respecto a los de las economías desarrolladas (ej., 13.4% y 59%

vamente). Hacia 1984 los consumos por habitantes y por año en el país se situaban en los siguientes niveles: (a) carne de res: 13.6 kgs, (b) cerdo: 18.7 kgs, (c) ave: 7.6 kgs, (d) huevo: 14.5 kgs, (e) leche: 90.3 lts (sin considerar las importaciones). Consecuentemente, a excepción quizás del consumo de huevo, todos los demás rubros son factibles de importantes grados de expansión, en la medida que los ingresos disponibles por habitante se vayan mejorando con el correr del tiempo. Siguiendo el mismo razonamiento, cabe esperar entonces presiones intensas por la vía de la demanda, para que la oferta de productos pecuarios nacionales se expanda suficientemente, generando requerimientos adicionales de insumos como el sorgo, así como de la aplicación de mejores niveles tecnológicos de estas explotaciones.

Los establecimientos avícolas y porcícolas se encuentran localizadas geográficamente en regiones similares, con claro predominio de las entidades federativas del centro del país. Así tenemos que Jalisco, Michoacán, México y Guanajuato aportan un 49% de la producción nacional porcina, y un 40% de la avícola (quitando Guanajuato y agregando Querétaro). En el norte destacan Sonora y Nuevo León con 10-13%, y en el trópico el estado de Veracruz con 5-9%, en ambos casos. En cuanto a la producción lechera nuevamente cuatro entidades del centro explican una contribución mayoritaria con 35% del total (ej., Jalisco, México, Durango y Guanajuato), con el norte un 12% (Coahuila y Chihuahua), y el trópico con otro 12% (Veracruz y Chiapas) (SARH, 1984).

Superponiendo la ubicación de la producción de sorgo nacional que fuera ya anunciada anteriormente, con la localización de los rubros pecuarios, vemos que en tres Estados coinciden ambos tipos de actividades (ej., Jalisco, Michoacán, y Guanajuato), mientras que las entidades de Tamaulipas y Sinaloa se encuentran estratégicamente también muy cercanas a los más importantes centros de demanda para este cereal. Con ello la producción de sorgo nacional presenta una relativa mejor distribución geográfica en el país respecto a sus mercados finales, que lo que podrían tener en principio el cultivo de yuca cuyo potencial mayor productivo se encuentra en zonas tropicales húmedas y secas, un tanto más alejadas de sus "clientes" mayoritarios.

Como soporte directo el desarrollo de la industria pecuaria intensiva moderna de México se ha ubicado el sector manufacturero de alimentos balanceados, el que ha crecido a un ritmo proporcional al de aquellos. Así tenemos que desde 1970 a 1984 su expansión alcanzó un ritmo promedio del 5.4% anual, al pasar de una producción de balanceados de 3.8 millones de tons en 1970 a 7.4 millones en 1980, y 8.5 millones en 1984. Sin embargo, es necesario reconocer que dicha expansión se ha visto reducida a principios de los '80, dada la caída del poder adquisitivo del trabajador mexicano, y con ella la demanda por proteínas de origen animal. Con el restablecimiento de la expansión de la economía nacional y la recuperación del poder de compra perdido y/o su posible mejoramiento, la demanda adicional por productos pecuarios no demorará en dejarse sentir (Burst, et al, 1984 y CANACINTRA, 1985).

C) Yuca en México

1) Características Generales

A pesar de la enorme diversidad de cultivos que se practican en México, llama la atención el escaso dinamismo histórico que ha tenido la yuca en este país. El primer síntoma de ellos es la carencia casi absoluta de estadísticas oficiales sobre la evolución que ha tenido esta raíz con el correr del tiempo. A pesar de ello existe la impresión de que pudieran encontrarse entre 3,000 y 6,000 has sembradas en todo el trópico mexicano, por parte de pequeños agricultores con miras a satisfacer sus propias necesidades, los que a su vez liberan remanentes menores para su colocación en los mercados urbanos en estado fresco. Ocasionalmente por ejemplo, es factible observar pequeños volúmenes de yuca fresca en la ciudad de México y sus alrededores.

Desde principios de la década de los '80, primeramente el Gobierno de Tabasco para luego asociarse el Gobierno Federal, han comenzado lentamente a dar impulso a esta actividad con objeto de generar productos que puedan ser eventualmente utilizados eficientemente en la alimentación animal de cerdos, aves y lechería. De esta manera a las ventajas en reducir la dependencia externa en sorgo y de los

consiguientes ahorros en divisas para el país, se le debe sumar a la yuca el beneficio de poder utilizar áreas agrícolas marginales con escasa productividad dado su uso extensivo actual (ej., ganadería de carne de los trópicos), a las que se podría incorporar económicamente una gran cantidad de mano de obra por unidad de superficie. Dos son los tipos de productos que más énfasis se ha buscado generar: (a) yuca deshidratada naturalmente en patios de concreto (y artificialmente en plantas especializadas, aunque este procedimiento todavía no ha podido ser concretado), y (b) yuca ensilada en silos de alta capacidad (ej., 1,300 tons). Mientras el primero tiene la ventaja de potencialmente permitir su movilización a regiones lejanas, el segundo mecanismo cumple con la necesidad de satisfacer mercados cercano a las zonas de producción.

Hacia 1985 el área total sembrada de yuca con fines comerciales en el Edo. de Tabasco había llegado a las 2,400 has, las que estaban siendo apoyadas por un programa de investigación aplicada en el cultivo de parte del INIFAP (SARH), y de los componentes de asistencia técnica, servicios de maquinaria agrícola, crédito y seguro agrícola aportados por los programas de Distritos de Temporal, BANRURAL y ANAGSA. En adición, se han venido construyendo importantes inversiones tendientes a facilitar el procesamiento de la yuca fresca. En este sentido cabe destacar la disponibilidad presente de 17 patios de secado con 2,000 m² cada uno (inversión fija total: US\$440,000), 10 silos de 1,300 tons de capacidad cada uno (inversión fija total: US\$320,000), a lo que hay que agregar la instalación de dos plantas que han sido adaptadas para el secamiento artificial de yuca, las que originalmente algunos de sus componentes servían para secar pescado en un caso, y alfalfa en el otro (dado que estos trabajos no han sido terminados, no se dispone del valor de estas inversiones).

Gracias a encuestas aplicadas en la región de Huimanguillo (Tabasco) tendientes a caracterizar el productor de yuca involucrado en este programa de expansión comercial de la raíz, se verificó que un 80% de los predios disponen de menos de 25 has totales de tierra, con 50% cultivando yuca entre 1 y 5 has, y un 30% entre 5 y 10 has. Dos

terceras partes de los productores no disponen de maquinaria propia ni en grupo, por lo que el Estado los suple con este requisito. Una tercera parte de ellos no disponen de ingresos fuera de los generados en sus propias fincas. En todo los casos la yuca se practica en monocultivo, pero en adición un 50% de las explotaciones siembran maíz para su propio autoconsumo. Más de un 90% de los productores realizan tratamiento químico a la estaca, 50% fertilizan el cultivo al mes de sembrada la vareta (lo recomendado según INIFAP), con 32% haciendo lo propio a los dos meses. Setenta porciento de los predios practican control de malezas en dos ocasiones durante el ciclo, y un 9% en tres oportunidades. La media de rendimiento alcanzado durante el último ciclo fue de 13.7 tons fresca/ha, a pesar de que un 60% de los agricultores argumentaban que sus terrenos no quedaron correctamente preparados para la siembra de yuca, 75% de ellos se salían del período óptimo de siembra (noviembre-enero), y 50% habían sufrido ataques severos de gusano cachón (41% en dos oportunidades).

2) Costos-Beneficios-Rentabilidad Privada de la Producción y Procesamiento del Cultivo de Yuca.

En esta sección se procederá a reportar los resultados económicos privados de la actividad yuca, tanto a nivel de producción como de su procesamiento en yuca deshidratada o ensilada. Sin lugar a dudas, si esta raíz tiene alguna oportunidad de ser utilizada ventajosamente dentro de la alimentación animal, el primer grupo de beneficiarios de estos procesos deberá ser el propio productor-procesador de yuca, quien tendrá que verificar el suficiente estímulo económico antes de emprender esta actividad.

El Cuadro 1 nos ilustra de la situación de un productor que practica eficientemente el paquete tecnológico recomendado por INIFAP para la zona de Huimanguillo, Tabasco. De ser así, cabe razonablemente esperar un rendimiento de 15 tons de yuca fresca/ha al cabo de un ciclo de 17 meses de duración (suponiendo una siembra en enero, con la cosecha hacia junio del siguiente año), sobre la base de que este producto tendrá su destino final en los patios de secado de concreto, cuyo

Cuadro 1. Costos, Ingresos y Beneficios Privados por Hectárea de la
Producción de Yuca en México (Huimanguillo), a Precios de
Julio de 1986.

A) Costos Privados de Producción

<u>CONCEPTO</u>	<u>T R A B A J O</u>		<u>INSUMOS</u>	<u>TOTAL</u>
	<u>Cantidad</u>	<u>Costo Total</u>		
(a) Preparación del Terreno (contratada).....			22,500	22,500
(b) Corte y Tratamiento de Estaca	4	6,000	2,134	8,134
(c) Estacas.....			4,050	4,050
(d) Siembra.....	6	9,000		9,000
(e) Fertilización.....	6	9,000	20,505	29,505
(f) Herbicida.....	2	3,000	9,000	12,000
(g) Deshierbe manual.....	16	24,000		24,000
(h) Insecticida.....	6	9,000	14,134	23,134
(i) Cosecha.....	21	31,500	8,800	40,300
(j) Intereses (8% sobre 2/3 costos, 17 meses).....			13,039	13,039
(k) Seguro Agrícola (6.25%).....			11,604	11,604
(l) Imprevistos (5%).....			9,863	9,863
T O T A L :	61	\$91,500	\$115,629	\$207,129

B) Ingresos Brutos

15 tons yuca fresca/ha a \$17,000/ton Mex\$255,000

C) Beneficios Privados

(a) Ingresos-Costos (255,000-207,129).....	Mex\$ 47,871
(b) Relación Insumo/Producto.....	81.2%
(c) Inversión en Tierra (\$100,000/ha durante 17 meses).....	Mex\$141,667
(d) Rentabilidad/ha en 17 meses.....	33.8%
(e) Rentabilidad/ha en 1 año..... (beneficio neto + administración)	23.9%

0

período de secado natural se extiende desde marzo a agosto. La cantidad de trabajo requerida por hectárea es de 61 jornales durante todo el ciclo, lo que representa un 44.2% de los costos privados totales. Entre los componentes más importantes de los restantes insumos se encuentran: i) la preparación del terreno con 10.9% (en base a maquinaria contratada suministrada por el Estado), ii) fertilizantes (9.9%), iii) herbicidas-insecticidad (11.2%), e intereses bancarios y seguro agrícola (6.3% y 5.6% respectivamente).

De ser correctos todos los supuestos anteriores, los beneficios netos esperados al final de los 17 meses serían de Mex\$47,871/ha (US\$72.5), con una relación insumo/producto de 81.2%. Teniendo en cuenta que el valor de la tierra en esta zona es de unos Mex\$100,000/ha (US\$151.5), la rentabilidad privada que obtendría un productor eficiente de yuca es de 23.9% anual (remuneración al capital en tierra, y a su propia administración). Esta cifra del 24% de rentabilidad se la puede considerar entonces, como altamente competitiva para cualquier inversionista privado. Por otra parte, es importante consignar que dada la anterior estructura de costos, así como del precio de la yuca fresca a mediados de 1986 a levantar de la finca (US\$25.76/ton), el productor no "ganaría ni perdería" de obtener un rendimiento de 12.2 tons/ha.

Otra característica del cultivo de yuca que se puede verificar en el Cuadro 1 es el alto valor agregado que genera su producción, puesto que los insumos propiamente dichos solo representan un 40% del valor total del producto obtenido (ello a pesar del "alto" nivel tecnológico de las prácticas agronómicas y culturales llevadas a cabo en Tabasco). Del 60% del valor generado adicional, la remuneración a la mano de obra es la que recibe la participación mayoritaria, seguida por la tierra y finalmente los intereses bancarios.

El Cuadro 2 computa los costos y beneficios de la actividad del secamiento de la yuca en patios de concreto. En este caso se desglosan los costos totales en sus componentes fijos y variables, a pesar de que los primeros solo representan un 6.8% de los totales. Es claro entonces

Cuadro 2. Costos, Ingresos y Beneficios Privados del Procesamiento de Yuca en Patios de Secado en México (Huimanguillo), a Precios de Julio de 1986.

A) Costos Privados del Procesamiento

<u>Concepto</u>	Mex\$/ ton seca	US\$/ ton seca
<u>1. Costos Fijos</u>		
(a) Depreciación de patio y bodega	1,473.5	2.23
(b) Depreciación de picadora	103.6	0.16
(c) Depreciación de motor picadora	291.6	0.44
(d) Depreciación de carreta	182.8	0.28
(e) Depreciación de báscula	60.9	0.09
(f) Depreciación de materiales y equipos	866.7	1.31
(g) Administración	1,014.1	1.54
Sub-Total	Mex\$3,993.2	US\$6.05
<u>2. Costos Variables</u>		
(a) Materia prima	44,200	66.97
(b) Flete del campo al patio	2,744.5	4.16
(c) Mantenimiento picadora y motor	294.7	0.45
(d) Combustibles y lubricantes	243.1	0.37
(e) Mano de obra	4,368.4	6.62
(f) Intereses Bancarios	276.5	0.42
(g) Imprevistos	2,606.4	3.95
Sub-Total	Mex\$54,733.6	US\$82.93
<u>3. Costos Totales</u>	Mex\$58,726.8	US\$88.98
<u>B) Ingresos Brutos/ton Seca en Patio de Secado.....</u>	Mex\$60,000	US\$90.91
<u>C) Beneficios Privados</u>		
(a) Ingresos-Costos/ton seca	Mex\$1,273.2	US\$ 1.93
(b) Relación Insumo/Producto	97.9%	97.9%
(c) Inversión en patio, bodega y equipo.....	Mex\$19:650,000	US\$29,773
(d) Beneficios Netos Totales/año	Mex\$587,581.8	US\$890.3
(e) Rentabilidad Privada/Capital Total Invertido.....	3.0%	3.0%

que la rentabilidad del secamiento dependerá esencialmente de tres categorías: a) el precio de la materia prima, b) la eficiencia física del proceso de secamiento (aquí se supone un factor de conversión de 2.6 como media de los seis meses de secado), y c) la organización de los productores vinculados al patio en cuestión, a efectos de que éste se use a su total capacidad. En definitiva este autor supone que cada patio de 2,000 m² puede generar en 6 meses de actividades, la cantidad de 460 tons de yuca seca.

Dados los costos y beneficios supuestos, la relación insumo/producto del proceso de secamiento en patios es muy estrecha (97.9%). Al estimar las inversiones totales incurridas y relacionarlas con los beneficios netos totales generados de las ventas de yuca seca, se arriba a una rentabilidad privada de solo 3% anual. Ello nos estaría indicando que el precio de la yuca fresca vigente en México a mediados de 1986, se encontraría por encima de su precio de equilibrio en relación al precio del producto ya seco. A pesar de ello es importante recalcar que la actividad del secamiento natural cubre perfectamente todos los costos en que se incurre, dejando una rentabilidad positiva, aunque por debajo de lo que podría esperar un inversionista.

Para obviar la discrepancia anterior entre las actividades de producción y procesamiento se construyó el Cuadro 3, en donde se ponen juntos ambos procesos. La justificación de ello es sencilla al notar que son los mismos productores de yuca los que en última instancia realizan el secamiento respectivo. A su vez el Cuadro 3 contempla también los costos de comercialización (ej., fletes) desde los patios hasta alguna planta de alimentos concentrados, o productor pecuario distante a unos 60-80 kms. Bajo estas circunstancias la relación insumo/producto se sitúa ahora en 85.0%, obteniéndose una rentabilidad anual privada en moneda constante del 10.1%. Nuevamente se verifica el alto valor agregado del producto yuca seca al representar la totalidad de los insumos un 42.5% del valor final de aquel. Particularmente, la mano de obra contribuye con un 28.5% del valor final. Más importante aún, el precio final de la yuca seca que es capaz de remunerar con un 10% anual el capital total invertido en ella, equivale a un 79.6% del

Cuadro 3. Costos, Ingresos y Beneficios Privados de la Producción -
Procesamiento de Yuca en México (Huimanguillo) con el Producto
Final Colacodo en Planta de Alimento Balanceado (precios a
julio de 1986).

A) Costos Privados de la Producción,
Procesamiento y Comercialización

(a) Costos de Producción/ha.....	Mex\$	207,129
(b) Costo de materia prima fresca/ton.....	Mex\$	13,808.6
(c) Costo de la materia prima seca/ton.....	Mex\$	35,902.4
(d) Costos fijos del procesamiento en patios/ton seca.....	Mex\$	3,993.2
(e) Costos variables del procesamiento en patio/ton seca (sin incluir materia prima)....	Mex\$	10,533.6
(f) Costos Totales/ton seca en patio (c + d + e).....	Mex\$	50,429.2
(g) Costo del flete/ton a planta de alimento balanceado.....	Mex\$	4,000.0
(h) Costo Total/ton seca en planta de alimento balanceado.....	Mex\$	54,429.2

B) Ingresos Brutos/ton Puesta en Planta de Alimento Balanceado.....	Mex\$	64,000

C) Beneficios Privados

(a) Ingresos Netos/ton seca.....	Mex\$	9,570.8
(b) Relación Insumo/Producto.....	85.0%	
(c) Ingresos Netos Total de yuca procesada en patio de secado..... (461.5 ton a \$9,570.8/ton)	Mex\$	4:416,924
(d) Inversión Total en Patio, Bodega, Equipos y Tierra requerida para trabajar el patio de secado a plena capacidad (80 has).....	Mex\$	30:983,360
(e) Retabilidad Privada/Capital Total Invertido en 17 meses).....	14.3%	
(f) Rentabilidad Privada/Capital Total Invertido en 12 meses.....	10.1%	

precio del sorgo colocado en la misma planta, de balanceados. Como se verá más adelante, este diferencial de precios entre estos dos ingredientes es más que suficiente como para que la yuca sea demandada ampliamente en la alimentación animal.

En resumen, la producción de yuca seca en patios de concreto debe ser vista como un proceso altamente competitivo en la medida que tanto su faz agronómica de producción, como la etapa de su transformación en seca se lleven a cabo dentro de márgenes razonables, pero eficientes (ej., alcanzar rendimientos de 15 tons/ha en fresco, y que los patios produzcan individualmente 460 tons de yuca seca por estación). Todas las circunstancias que contribuyan a aportarnos de estas dos grandes metas de eficiencia, afectará notablemente la rentabilidad del cultivo y su competitividad con rubros alternativos.

Pasando ahora a estudiar la rentabilidad de la yuca ensilada en Tabasco, es necesario precisar que bajo esta opción la rentabilidad de la producción de yuca fresca debería incrementarse aún más en relación a aquella destinada a los patios de concreto. La razón de ello es que ahora la yuca podría ser cosechada a partir del año de siembra con lo que, por un lado, el rendimiento en fresco no debería ser significativamente inferior a la yuca cosechada más tardíamente, pero además, los intereses bancarios y fundamentalmente el capital fijo en tierra se extenderían ahora solamente por 12 meses. Con ello la inversión en tierra total sobre la cual se generan los beneficios netos de la producción de yuca se reducen casi un 30%, lo que indudablemente tendrá una repercusión favorable sobre la rentabilidad privada (y social) del cultivo. Adicionalmente, y a diferencia del caso de la producción de yuca deshidratada, el proceso de ensilaje de yuca fresca tal cual ha sido fomentado en Tabasco, se lleva a cabo por grupos de productores esencialmente diferentes a los yuqueros (ej., productores de cerdos), por lo que se estudiará la estructura de costos de este procesamiento en forma separada al de producción.

El Cuadro 4 presenta los costos fijos y variables de la producción de 1 kg de yuca ensilada. Nuevamente se verifica la escasa ponderación

Cuadro 4: Costos Privados de Yuca Ensilada en La Chontalpa, Tabasco, México (precios: agosto, 1986).

<u>Costos Variables</u>	
(a) Materia prima	Mex\$17.00/kg
(b) Cargado a camión	Mex\$ 0.40/kg
(c) Descargado del camión	Mex\$ 0.40/kg
(d) Flete a La Chontalpa	Mex\$ 4.00/kg
(e) Picado de la Yuca	Mex\$ 0.55/kg
(f) Apisonado de la yuca	Mex\$ 0.30/kg
(g) Capa plástica	Mex\$ 0.20/kg
Sub-Total	Mex\$22.85/kg
(h) Costo de oportunidad del capital variable, al 10% anual por un año	\$ 2.29/kg
(i) Imprevistos (5%)	\$ 1.26/kg
Total Costos Variables	\$26.40/kg
<u>Costos Fijos</u>	
(a) Depreciación del silo	\$ 0.96/kg
(b) Costo de oportunidad de la inversión inicial, al 10% anual	\$ 1.60/kg
Total Costos Fijos	\$ 2.56/kg
<u>Costo Total (preliminar)</u>	\$28.96/kg
Pérdida del 17% en peso por escurrimiento y otros deterioros	\$ 4.92/kg
<u>Costo Total Final</u>	<u>\$33.88/kg</u>

*nutritional content - can a feed cost feed model be developed?
based on nitrogen content etc (need nutritional content)*

de los costos fijos dentro de los costos totales, al representar aquellos un 7.6% de los totales. Una vez terminado el proceso de ensilaje, la yuca bajo esta forma quedaría con aproximadamente un 50% de humedad, con lo que llevando el costo por kg ensilado (Mex\$33.88) al de su correspondiente en base seca (Mex\$67.76), este producto resulta altamente competitivo con el del sorgo granífero en base seca colocado en el mismo lugar (ej., Mex\$80.4/kg con 14% de humedad, implicando Mex\$93.49/kg en base seca). Esta relación de precios yuca/sorgo de 0.72 es indudablemente muy favorable a la raíz, situación que está siendo comprobada por los productores de cerdos de la región (ej., La Chontalpa) quienes están haciendo un amplio uso de la misma durante este último año, como forma de abatir significativamente sus costos de alimentación y mantenerse competitivos en su negocio.

3) Evaluación Social de la Producción, Procesamiento y Comercialización del Cultivo de Yuca.

Toca ahora ajustar los resultados de la evaluación privada del cultivo de yuca a sus correspondientes parámetros "sociales", esto es, sobre la base de que el costo de oportunidad de la producción que enfrenta cualquier economía serían los precios internacionales en un momento dado. En el presente estudio se tomó el nivel de precio de 1985 para productos e insumos, como los representativos de las tendencias de largo plazo en dichas categorías. El Cuadro 5 nos ayuda a organizarnos al respecto.

Una primera categoría de insumos es el de la mano de obra. El precio "sombra" (o social) de este factor de producción se lo dejó exactamente igual al de su precio de mercado en el país, por entender que en la región de Tabasco no existirían excedentes de mano de obra rural (desempleo) dada la fuerte competencia que ejerce la industria petrolera local. Sin embargo, existen indicaciones de que entre los principales rubros en que se relaciona esta investigación (ej., maíz, sorgo, yuca, y otros cultivos), existiría un cierto grado de proteccionismo comercial artificial, con lo que el valor social marginal medio del trabajo podría ser menor a su costo presente, por lo que podría

Cuadro 5: Evaluación Social de la Producción, Procesamiento y Comercialización del Cultivo de Yuca en México.

A) Costos Sociales de Producción

<u>CONCEPTO</u>	<u>T R A B A J O</u>		<u>INSUMOS</u>	<u>TOTAL</u>
	<u>Cantidad</u>	<u>Costo Total</u>		
(a) Preparación del Terreno			36,670	36,670
(b) Corte y Tratamiento de Estaca	4	6,000	3,497	9,497
(c) Estacas			4,050	4,050
(d) Siembra	6	9,000		9,000
(e) Fertilización	6	9,000	41,421	50,421
(f) Herbicida	2	3,000	10,038	13,038
(g) Deshierbe manual	16	24,000		24,000
(h) Insecticida	6	9,000	12,963	21,963
(i) Cosecha	21	31,500	14,342	45,842
(j) Intereses (8% sobre 2/3 costos, en 17 meses)			16,205	16,205
(k) Seguro Agrícola (6.25%)			14,418	14,418
(l) Imprevistos (5%)			12,255	12,255
T O T A L :	61	\$91,500	\$165,859	\$257,359

B) Costos Sociales Procesamiento y Comercialización

(a) Costo Social de Producción/ha	Mex\$257,359
(b) Costo de la Materia Prima Fresca/ton	Mex\$ 17,157
(c) Costo Materia Prima Seca/ton	Mex\$ 44,608
(d) Costos Fijos Procesamiento en Patio/ton	Mex\$ 3,993

(e) Costos Variables Procesamiento en Patio/ton	Mex\$ 11,270
- flete campo al patio: \$3,178	
- comb y lubricantes: 486	
- mant. picadora y motor: 295	
- mano de obra: 4,368	
- intereses bancarios 282	
- imprevistos 2,661	
(f) Costo Total/ton seca en patio (c + d + e)	Mex\$ 59,871
(g) Flete/ton desde patio a planta de alimento balanceado	Mex\$ 4,800
(h) Costo Total/ton seca en planta de alimento balanceado	Mex\$ 64,671
C) <u>Valor Social de la Yuca Deshidratada/ton</u> <u>Puestas en Planta de Alimento Balanceado</u>	Mex\$ 62,542
D) <u>Beneficio Social</u> <u>Relación Insumo/Producto</u>	-Mex\$ 2,129 1.034

corresponder un ajuste a la baja en dicho rubro. Además, de expandirse las siembras dedicadas a la yuca a otras regiones de agricultura marginal en el país, es posible enfrentar condiciones de mayor niveles de desempleo a lo visto en Tabasco, situación ésta que reforzaría el argumento de imputar un menor costo social al trabajo.

Un segundo rubro es el del costo de los servicios de la maquinaria agrícola, en donde sí se detectaron importantes componentes de subsidios que benefician al productor de yuca. En este sentido se concluyó que el costo real para la sociedad debería ser un 63% superior al que se le imputa al productor por la vía de la contratación de equipo agrícola de la SARH y del Gobierno de Tabasco. Esta cifra sale de una estimación de precio sombra de US\$9.26/hora de trabajo del tractor con su implemento (ej., arado, disquera, rastra, etc), requiriendo de 6 horas tractor/ha la preparación completa del terreno previo a su siembra, así como de una cotización del peso mexicano en el mercado libre de \$660/dólar americano (Saez, 1986).

Otro importante insumo en donde existen grandes discrepancias entre el mercado interno y el internacional es en el rubro de los fertilizantes. Aquí es posible verificar que el precio de la urea que observa el productor mexicano es de solo un 36% del precio cif, más su costo de distribución interna en el país. En el caso del superfosfato triple y el cloruro de potasio, las mismas relaciones se ubican en 51% y 73%, respectivamente. Consecuentemente, si combinamos estos tres fertilizantes en las proporciones utilizadas de yuca se arriba a que el costo social de la fertilización en yuca debería encontrarse en un 102% superior al vigente.

En contraposición, para los rubros herbicidas (ej., Gesaprim) e insecticidas (ej., Malathion), el costo social de ellos combinadamente es un 99.4% del precio interno. En lo que tiene que ver con los rubros estacas, intereses bancarios, seguro agrícola e imprevistos, sus cálculos siguen siendo iguales a los de la evaluación privada.

En base a todas las consideraciones anteriores se deriva que el

costo social/ha de la producción de yuca se eleva colectivamente en un 24.3%, con lo que se reduce significativamente el margen anteriormente detectado mediante la evaluación privada. Los importantes subsidios vigentes a los servicios de mecanización y a los fertilizantes son las principales razones de estos incrementos.

En lo que tiene que ver con la comparación privada y social de los costos fijos y variables del procesamiento de la yuca a nivel de patios, se llega a que el diferencial de costos entre ellos es de apenas un 5.1% en favor de los últimos, motivado exclusivamente por el subsidio a los combustibles (diesel) el que se sitúa en el orden de un 50%. Todas las demás categorías se suponen equivalentes entre sí. Finalmente cuando se moviliza la yuca deshidratada del patio a la planta de alimentos balanceados, aparece de nuevo el subsidio al diesel, con lo que globalmente el transporte interno estaría artificialmente rebajado en un 20% (Byerlee y Longmire, 1986).

En definitiva, los costos sociales totales de la producción y secamiento de la yuca en México superarían en un 3.4% al precio del producto final valorado a su precio internacional cif, en adición a su transportación interna (ej., 80% del precio fob 1985 del sorgo en los puertos del Golfo de EEUU, más un 15% por concepto de fletes internacionales e internos, descargas, etc: US\$94.76/ton). Resulta claro entonces que la rentabilidad social se encuentra muy cerca del cero, de ocurrir un pequeño cambio alcista en el precio del cereal, y/o de considerar que quizás el margen de comercialización de traer el producto desde el exterior y colocarlo en los mercados de consumo internos de México sea de un 19% en promedio, en lugar del 15% como se supuso ^{2/}, y/o que el componente de subsidio a los servicios de maquinaria agrícola no sean tan elevados, y/o que el costo social de la

^{2/} Se recuerda que en el caso del maíz se había aceptado como razonable un margen de comercialización del 31% para cubrir el costo de la movilización del producto, desde el lugar de origen en puertos internacionales hasta su destino final en el consumidor medio del país. Sin embargo, es preciso reconocer que mientras el consumo del maíz se practica en cada punto del territorio nacional, el del sorgo su demanda se concentra en pocas regiones las que a su vez disponen de relativas buenas comunicaciones.

mano de obra sea en realidad menor al de su precio de mercado, etc. Consecuentemente sería un tanto arriesgado el concluir de que por ser la rentabilidad social ligeramente negativa se debería desestimular la producción de yuca en el país.

Uno de los mecanismos para cuantificar los incentivos implícitos en la política de precios de un rubro en particular es mediante la determinación de los coeficientes nominales y efectivos de protección. Mientras el coeficiente nominal solo contempla los precios finales del producto valorado a sus niveles internacionales y domésticos en una región representativa de la producción (o consumo) del bien en cuestión en el país, el coeficiente efectivo de protección toma en cuenta en adición, todos los insumos que intervienen en el proceso productivo con la condición de que tengan contactos reales o potenciales con los mercados internacionales (ej., maquinaria, agroquímicos, semillas, combustibles, etc), valorados ellos también a ambos niveles de precios (Scandizzo y Bruce, 1980). Dado que en las páginas anteriores se arribó a una estimación de los costos sociales así como privados de la producción-procesamiento de yuca, resulta fácil entonces computar dichas medidas de política.

Comenzando por el coeficiente nominal de protección (CNP) se concluye que el precio de yuca deshidratada a mediados de 1986 puesta en el lugar en donde se utilizará como ingrediente en las dietas animales, es prácticamente equivalente al de su costo de oportunidad internacional. Su CNP es de 1.023 (ej., 64,000 / 62,542). Haciendo lo propio con el precio del sorgo se arriba a un CNP de 1.028 (ej., 80,400 / 78,177) muy similar al de yuca. De aquí se deriva entonces que desde este punto de vista, la política oficial implícita de México hacia la yuca y el sorgo es completamente neutra. Sin embargo, cuando se pasa a computar la medida efectiva de protección (CEP) para tomar en consideración también la política de precios a los insumos comercializables en el campo internacional, la conclusión anterior cambia radicalmente. Así, al calcular el valor agregado de la producción de 1 ton de yuca deshidratada a precios domésticos, en relación a este mismo concepto pero medido a precios sombras se arriba a un CEP de 1.43 (ej., (64,000

- 26,675) / (62,542 - 36,404). Ello nos indica claramente que sí existe una política de incentivo a la raíz, no por la vía de precios artificialmente elevados en el valor del producto final, pero en cambio reduciendo deliberadamente el precio de algunos insumos importantes. Precisamente esto fue lo que observamos anteriormente cuando se reportó que los costos sociales de producción de yuca eran significativamente más elevados a sus costos privados. Si bien no se derivó el CEP para el sorgo, su respectivo coeficiente deberá ser también mayor a la unidad, por la presencia de los mismos subsidios a los insumos productivos.

El paso siguiente es derivar la medida final de ventajas comparativas de la producción de yuca en México por intermedio del coeficiente "DRC", el cual relaciona la remuneración a los factores internos de producción: tierra, trabajo y capital medidos a sus precios sombras, con respecto al valor agregado de la producción del bien en cuestión evaluado también a sus precios sombras. Toda esta información ya se dispone de lo visto en el Cuadro 5. Al proceder a calcular dicho índice se arriba a un valor de $DRC = 1.08$ (ej., $28,267 / (62,542 - 36,404)$), significando con ello que la remuneración (costo) a los factores fijos internos de producción que hacen posible la generación de yuca seca en el país es ligeramente mayor que el valor agregado de dicho producto, con el cual se remunera precisamente a tales factores. Es necesario hacer notar que el costo social de la tierra en donde la yuca sería producida se supone igual a cero, sobre la base de sus características marginales. De comprobarse que bajo esas mismas condiciones, socialmente la tierra aportaría valores positivos, nuestra estimación anterior de DRC para la yuca en México estaría subvalorada.

Se recuerda nuevamente que dada la magnitud del DRC de yuca tal cual fuera computado, con un ligero aumento en el precio internacional del sorgo y/o en sus costos de transferencia para su introducción al país del orden de un 3.4%, dicho índice se iguala a la unidad, implicando una posición de "indiferencia" en la decisión de producir localmente el producto vs su importación. Una conclusión similar se arribaría de aplicarse un descuento del 10% al costo unitario de la

mano de obra al ajustarla por su sobrevaloración en virtud del proteccionismo oficial a la producción nacional, y/o la incidencia de desempleo rural en áreas marginales.

Aún reconociendo que la yuca y el sorgo no compiten en principio por el mismo uso de tierra en el país, a modo de referencia se derivó la evaluación social de la producción de sorgo bajo condiciones de riego y temporal (Apéndice 2.9 y 2.10). En ambas circunstancias los resultados son altamente favorables a este cereal, con lo que dicho rubro no necesitaría de ningún tipo de estímulo adicional para incentivar su producción, que no sea el de su propio precio equivalente internacional. Incluso frecuentemente es posible sacar una segunda cosecha de sorgo de la misma tierra en el año, u obtener una producción adicional de arroz o de alguna hortaliza de alto valor (ej., melón), todo lo cual incrementaría aún más su contribución social. En definitiva no se computó su respectivo DRC por desconocerse cual sería el costo social de la tierra en donde se practica el sorgo, la cual seguramente tendrá que ser un valor positivo. A pesar de ello no cabe duda de que su DRC deberá ser claramente menor a la unidad.

4) Estimación de la Demanda Potencial de Yuca Deshidratada

Comprobada la adecuada rentabilidad privada de la producción-procesamiento de yuca en México sobre la base de las eficiencias físicas conseguidas en Tabasco, y que desde el punto de vista nacional dicho cultivo al menos no es suficientemente negativo como para desestimular su apoyo, llega el momento de realizar una primera aproximación a la estimación del potencial de demanda nacional por esta raíz. Decimos primera aproximación puesto que considerando el grado de desarrollo presente del cultivo y de su concentración en un lugar muy específico de México, se carecen de suficientes datos agronómicos como para poder ponderar su comportamiento técnico en otras áreas con iguales o mejores posibilidades de crecimiento a las actuales (ej., sur de Veracruz, Campeche, Yucatán, ciertas regiones en Jalisco, Oaxaca, Guerrero, etc.). En consecuencia, necesariamente se tendrá que extrapolar a nivel de todo el país, los resultados válidos para una región.

Dado el escaso énfasis histórico que ha tenido el cultivo en el pasado, ello determina que se tenga que eliminar como alternativas metodológicas a los procedimientos econométricos que demanden series de tiempo de precios y cantidades en los componentes de oferta y demanda. En su lugar se seleccionó la técnica de la optimización económica de los recursos sujeta a restricciones lineales, denominada programación lineal (Hillier y Lieberman, 1974). Mediante ella se busca en el contexto de la presente investigación, minimizar el costo de producir una cantidad determinada de alimento balanceado mediante la combinación de múltiples ingredientes que se complementan y compiten entre sí, al aportar diferentes proporciones de compuestos orgánicos (ej., proteínas, carbohidratos, grasa, fibra, etc.) y minerales (P, Ca, K, etc.). Conociendo los requerimientos nutricionales específicos para cada especie animal (ej., aves ponedoras, pollos de engorda, cerdos, ganado lechero, etc.), y dentro de ellas, las necesidades más particulares de los animales en cuestión en función del estado fisiológico y de crecimiento en que se encuentren, se podrá tener soluciones técnico-económicas diferentes entre sí, las que posteriormente se podrán agregar por especie, y de la correcta ponderación entre especies, se podrá arribar a una estimación de la demanda potencial de un ingrediente en particular.

En el contexto de este trabajo lógicamente interesaba conocer el comportamiento de un nuevo ingrediente para la fabricación de dietas animales en México (ej., yuca deshidratada) en relación a los productos tradicionalmente utilizados en su preparación (ej., sorgo, pasta de soya, de pescado, salvado de trigo, etc.). Para cada uno de estos insumos se estableció su composición químico-biológica promedio, así como el costo unitario de cada una de ellas a nivel de planta de alimento balanceado. Justamente es en este último requerimiento de datos donde la información que se utilizó fue la vigente para Tabasco, situación ésta que podría no coincidir en otras regiones. Los parámetros técnicos y económicos de los ingredientes más importantes estudiados se encuentran en el Apéndice 3.1. Por su parte, en lo que tiene que ver con los requerimientos nutricionales por especie y categoría, se sugiere consultar el trabajo de Saez y Martínez Cruz, 1986.

En definitiva se corrieron 16 modelos diferentes de mínimo costo encontrándose que las proporciones más significativas de yuca por 100 kgs de ración fueron demandadas por el ganado lechero en producción (27.6%), seguido por cerdos (19.9% en promedio), aves de postura (5.1% en promedio), y pollos de engorda (4.7% en promedio). Sin embargo, al combinar la concentración de yuca/100 kgs de ración que entra en las soluciones óptimas, con respecto a la ponderación que tiene tal especie dentro de la demanda total de alimento balanceado a nivel nacional, se aprecia que son los cerdos los que podrían demandar hasta un 49.5% de la yuca a ser producida, seguidos por las explotaciones lecheras con un 28%, y la avicultura con 22.5% (7.3% en pollos de engorda y 15.2% en aves de postura). En adición se encontró que estas soluciones son estables a pesar de que el precio de la yuca deshidratada puesta en planta se acerque a un 81.4% del precio del sorgo en dicho lugar para el caso de las dietas de cerdos, 80.4% en pollos de engorda, 88.3% en aves de postura y 83.9% en ganado lechero (Apéndice 3.2 y 3.3).

A efectos de evaluar el impacto que tendría la yuca deshidratada respecto a la demanda en los demás ingredientes (especialmente, sorgo y pasta de soya), se corrieron nuevamente todos los modelos, pero ahora sin la inclusión de yuca como alternativa a ser seleccionada. De esta manera se obtuvieron soluciones óptimas que tendrían que coincidir aproximadamente con la estructura de demanda presente de ingredientes en dietas animales en México. Al comparar estas soluciones con las primeras obtenidas se puede calcular el grado de ahorro en unos casos, y de demanda adicional en otros, requerida para acomodar la introducción de yuca en la mezcla (Apéndice 3.4).

Finalmente, se arribó al cómputo de la demanda total nacional de yuca y su repercusión final sobre el sorgo y la pasta de soya. Tomando cifras nacionales del consumo de alimentos balanceados de 1984, se estima que el volumen potencialmente requerido de yuca deshidratada por dicha industria sería del orden de 1:056,117 tons, lo cual permitiría ahorrar 1:179,067 tons de sorgo, aunque incrementaría las necesidades de pasta de soya en 193,826 tons, generando un beneficio neto en divisas de US\$84.7 millones al año. Sin embargo, dado el dinamismo

histórico que ha caracterizado al sector de balanceados de México, suponiendo un crecimiento conservador del 4% anual hasta 1990, se llegó a que en ese año la demanda total por yuca del sector pecuario de México sería de 1:336,000 tons anuales (implicando un área a sembrar de 231,570 has), con un ahorro en sorgo de 1:491,500 tons, y un incremento en pasta de soya de 245,000 tons. El saldo neto en divisas sería en este caso de US\$114.2 millones anuales, generándose a su vez una demanda adicional de empleo por la vía de la producción y procesamiento de la yuca del orden de los 61,500 hombres-año, aplicados en áreas con baja productividad actual (Apéndice 3.5).

Referencias

- BANAMEX. Examen de la Situación Económica de México. Número 724, Marzo, 1986.
- Banco Mundial. Informe Sobre el Desarrollo Mundial 1986, Washington, D.C., 1986.
- Burst, Andrew, et al. Growth and Structure of the Mexican Feedstuffs Industry. University of Missouri-Columbia, Special Report 315, Nov., 1984.
- Byerlee, Derek y Jim Longmire. Comparative Advantage and Policy Incentives for Wheat Production in Rainfed and Irrigated Areas of Mexico. CIMMYT Economics Program, Working Paper No. 01/86, Marzo 1986.
- CANACINTRA. La Industria Alimenticia Animal en México (en cifras), 1985.
- FAO. Trade Yearbook, Vol. 38, 1984.
- Hiller, F.S. y G.J. Lieberman. Operations Research. Holden-Day Inc. Second Edition, 1974.
- International Monetary Fund. International Financial Statistics Yearbook 1985.
- Saez, Roberto. El Sector Agropecuario de México, CIAT, Octubre 1985.
- Saez, Roberto. Ventajas Comparativas en la Producción de Maíz, Sorgo y Yuca Deshidratada en Panamá. CIAT, Octubre, 1986.
- Saez, Roberto y Víctor Martínez Cruz. Estimación de la Demanda Potencial de Yuca en México, para su Utilización en la Preparación de Alimentos Concentrados Animales, CIAT, Abril, 1986.
- Secretaría de Planeación y Presupuesto, México. Sistema de Cuentas Nacionales de México, varios años.
- SARH, Dirección General de Economía Agrícola. Consumos Aparentes de Productos Agrícolas, 1925-1982.
- SARH, Estadísticas Pecuarias, varios años.
- Scandizzo, Pasquale L. y Colin Bruce. Methodologies for Measuring Agricultural Price Intervention Effects. World Bank Staff Working Paper No. 394, Junio 1980.
- Unión Nacional de Agricultores. Boletín No. 3, Vol. 2, 1985.

Apéndice 1.1. Principales Componentes de las Variables de Cuentas Nacionales para México, 1953-1985.

Año	Consumo de Gobierno	Consumo	Formación de	Exportaciones	Importaciones	Producto	Producto	PIB	PIB Real Per Cápita \$ del '80
			Capital Fijo			Interno	Nacional	Real	
			Bruto Privado			Bruto (PIB)	Bruto (PNB)	billones \$ del'80	
----- billones de pesos mexicanos -----									
1953	2.6	48.7	8.1	8.0	8.5	58.9	58.4	712.3	24,819
1954	3.1	58.8	10.1	11.5	11.3	72.2	71.5	783.1	26,447
1955	3.8	70.7	12.6	14.7	13.6	88.2	87.3	850.0	27,814
1956	4.4	79.5	16.8	16.0	16.1	100.6	99.3	907.9	28,767
1957	5.2	93.6	19.1	15.2	17.6	115.5	114.2	976.4	29,942
1958	5.9	105.7	18.9	15.3	17.2	128.6	127.2	1,028.9	30,531
1959	6.2	112.3	19.6	15.9	16.3	137.7	136.2	1,059.3	30,387
1960	8.0	123.9	23.2	16.6	18.7	155.9	154.1	1,145.3	31,770
1961	8.6	131.0	24.1	17.8	18.7	165.7	163.8	1,201.6	32,240
1962	9.6	142.0	24.8	19.4	19.0	179.8	177.5	1,257.9	32,639
1963	14.2	144.0	32.6	19.5	20.8	194.8	193.5	1,358.4	34,071
1964	16.6	161.9	41.0	21.0	24.4	221.4	219.8	1,517.4	36,785
1965	17.7	190.7	44.2	24.5	25.1	257.2	250.6	1,615.6	37,845
1966	20.4	209.1	50.2	26.6	26.5	287.2	281.0	1,727.5	39,137
1967	22.5	226.2	59.6	26.8	28.8	306.3	304.1	1,836.3	40,208
1968	25.9	247.8	65.7	29.0	34.2	339.1	336.0	1,985.4	42,001
1969	28.8	270.0	72.8	34.4	37.5	374.9	371.6	2,111.0	43,143
1970	32.2	319.5	88.7	34.4	42.9	444.3	438.6	2,257.1	44,528
1971	37.3	358.8	88.1	37.4	42.7	490.0	483.5	2,351.1	44,826
1972	48.7	405.6	107.1	45.5	49.9	564.7	557.3	2,550.8	47,002
1973	63.4	487.0	133.3	58.1	65.4	690.9	680.9	2,765.1	49,236
1974	82.3	628.3	178.9	75.7	95.2	899.7	884.7	2,934.3	50,487
1975	113.5	755.9	235.6	75.8	105.8	1,100.0	1,082.1	3,098.9	51,520
1976	150.9	933.4	288.4	116.4	135.3	1,371.0	1,342.0	3,230.0	51,821
1977	199.0	1,226.1	363.3	190.8	189.0	1,849.3	1,806.4	3,341.2	51,729
1978	255.2	1,543.8	492.4	244.7	258.0	2,337.4	2,284.9	3,617.1	55,282
1979	334.3	1,975.9	718.5	343.3	382.0	3,067.5	2,990.4	3,948.3	58,563
1980	462.8	2,651.5	1,032.9	537.2	577.8	4,276.5	4,159.3	4,276.5	61,665
1981	684.5	3,583.8	1,509.4	701.6	798.1	5,874.4	5,674.3	4,616.9	64,853
1982	1,057.6	5,776.1	2,098.8	1,636.5	1,053.9	9,255.8	8,908.2	4,591.3	62,886
1983	1,590.3	10,356.0	2,972.3	3,340.6	1,617.4 ¹	17,429.7	16,099.9	4,378.1	58,390
1984	2,737.0	17,468.6	5,163.6	5,101.9	2,775.3	28,748.9	27,029.6	4,508.6	58,713
1985						46,588.5		4,630.0	58,966

Año	Ingresos Públicos	Egresos Públicos (Consumo + Inversión)	Déficit Gubernamental	Préstamos Netos Internos Tomados por el Gobierno	Préstamos Netos Tomados por el Gobierno desde el Exterior	Déficit Gubernamental en Relación con PBD
-----billones de pesos mexicanos-----						%
1966	27.01	31.87	4.86	4.14	0.67	1.7
1967	28.86	33.87	5.01	4.22	1.48	1.6
1968	34.32	39.35	5.03	5.54	1.80	1.5
1969	37.85	46.93	9.08	7.48	1.49	2.4
1970	42.48	48.56	6.08	5.04	2.04	1.4
1971	47.49	51.65	4.16	5.02	0.34	0.8
1972	58.24	67.31	17.04	13.52	2.57	3.0
1973	69.54	88.05	27.48	25.10	3.30	4.0
1974	95.31	123.92	34.25	27.85	11.64	3.8
1975	133.40	161.61	53.62	40.29	15.50	4.9
1976	168.58	211.61	64.07	50.48	25.27	4.7
1977	240.72	285.52	61.13	54.68	10.32	3.3
1978	322.75	367.46	62.74	64.60	6.94	2.7
1979	438.62	505.21	101.88	103.31	-7.09	3.3
1980	674.99	750.20	133.68	147.49	-3.30	3.1
1981	894.28	1,182.24	392.33	238.08	123.76	6.7
1982	1,519.90	2,829.30	1,453.60	1,171.60	228.20	15.7
1983	3,221.70	4,468.20	1,362.90	764.70	561.30	7.8

Fuente: International Financial Statistics, Yearbook 1985, I.M.F.

Nota: La Columna de Déficit Gubernamental no coincide en todos los casos con la diferencia entre ingresos y egresos públicos, ya que hay dos componentes que no se muestran en el cuadro; (i) concesiones al gobierno (grants) lo cual suma a los ingresos, y (ii) préstamos netos del sector público a particulares, los que suman a los egresos.

Apéndice 1.3: Comportamiento del Nivel General de Precios al Consumidor, Índice General de Salarios y Tipo de Cambio, México, y Nivel General de Precios al Consumidor en U.S.A., 1953-1985.

Año	Nivel Precios al Consumidor México	Índice de Salarios México	Tipo de Cambio, México	Nivel Precio al Consumidor U.S.A.
1953	10.34	5	8.65	32.5
1954	10.87	5	11.22	32.6
1955	12.59	6	12.50	32.5
1956	13.20	7	12.50	33.0
1957	13.87	7	12.50	34.1
1958	15.56	8	12.50	35.1
1959	15.96	8	12.50	35.4
1960	16.75	9	12.50	35.9
1961	17.02	10	12.50	36.3
1962	17.22	11	12.50	36.7
1963	17.32	12	12.50	37.2
1964	17.73	14	12.50	37.6
1965	18.36	15	12.50	38.2
1966	19.13	15	12.50	39.4
1967	19.72	16	12.50	40.5
1968	19.89	17	12.50	42.2
1969	20.56	18	12.50	44.5
1970	21.63	19	12.50	47.1
1971	22.77	20	12.50	49.1
1972	23.90	22	12.50	50.8
1973	26.78	24	12.50	53.9
1974	33.15	31	12.50	59.8
1975	38.17	37	12.50	65.3
1976	44.19	47	15.43	69.1
1977	57.01	62	22.57	73.6
1978	66.97	71	22.77	79.2
1979	79.14	83	22.81	88.1
1980	100.00	100	22.95	100.0
1981	127.93	129.5	24.52	110.4
1982	203.31	207.2	54.99	117.1
1983	410.40	311.3	120.09	120.9
1984	679.00	494.2	167.83	126.1
1985	1,071.20	n/d	256.87	130.5

Fuente: International Financial Statistics, Yearbook 1985, I.M.F.

Apéndice 1.4. Política Monetaria de México, 1953-1985: Evolución del Circulante

Año	Circulante Corriente	Deflector del PIB	Circulante Real
	billones pesos		billones pesos
1953	10.1	8.3	1.22
1954	12.0	9.2	1.30
1955	14.1	10.4	1.36
1956	15.7	11.1	1.41
1957	17.4	11.8	1.47
1958	19.2	12.5	1.54
1959	21.1	13.0	1.62
1960	22.8	13.6	1.68
1961	24.5	13.8	1.78
1962	27.6	14.3	1.93
1963	32.4	14.3	2.27
1964	37.8	14.6	2.59
1965	40.6	15.9	2.55
1966	45.7	16.6	2.75
1967	50.1	16.7	3.00
1968	57.1	17.1	3.34
1969	65.4	17.8	3.67
1970	72.0	19.7	3.65
1971	77.5	20.8	3.73
1972	91.2	22.1	4.13
1973	115.1	25.0	4.60
1974	139.2	30.7	4.53
1975	164.1	35.5	4.62
1976	243.0	42.4	5.73
1977	526.0	55.3	9.51
1978	700.3	64.6	10.84
1979	950.5	77.7	12.23
1980	1,297.9	100.0	12.98
1981	1,939.8	127.2	15.25
1982	3,304.0	205.1	16.11
1983	5,398.1	398.1	13.56
1984	9,011.6	637.6	14.13
1985	13,135.6	1,006.2	13.05

fuente: International Financial Statistics, Yearbook 1985, I.M.F.

Apéndice 1.5: Comercio Exterior de México, 1953 - 1985: Volúmenes Monetarios.

Año	Exportaciones Totales	Petróleo	Algodón	Café	Camarón	Azúcar	Importaciones Totales (fob)	Importaciones Totales (cif)
-----billones de pesos-----								
1953	5.12	0.23	1.31	0.70	0.12	0.51	6.65	6.99
1954	7.39	0.44	2.15	1.00	0.14	0.66	8.50	8.93
1955	9.81	0.64	2.87	1.30	0.19	0.72	10.52	11.05
1956	10.42	0.67	3.29	1.31	0.25	0.07	12.76	13.40
1957	9.18	0.50	2.13	1.36	0.26	0.15	13.75	14.44
1958	9.18	0.38	2.38	0.99	0.40	0.18	13.44	14.11
1959	9.38	0.38	2.49	0.87	0.49	0.24	11.98	12.58
1960	9.56	0.26	1.97	0.90	0.43	0.73	14.13	14.83
1961	10.33	0.27	2.00	0.90	0.52	0.91	13.56	14.23
1962	11.64	0.27	2.73	0.88	0.62	0.58	13.61	14.29
1963	12.11	0.27	2.45	0.61	0.72	0.86	14.76	15.50
1964	12.88	0.30	2.13	1.19	0.56	1.12	17.77	18.66
1965	14.01	0.50	2.65	0.91	0.55	0.91	18.57	19.50
1966	14.99	0.49	2.77	1.05	0.66	0.83	19.11	20.06
1967	14.20	0.49	1.80	0.75	0.77	1.02	20.78	21.82
1968	15.67	0.42	2.13	0.97	0.62	1.20	23.33	24.50
1969	17.87	0.50	2.45	0.92	0.57	1.30	24.74	25.98
1970	17.54	0.48	1.55	1.08	0.79	1.22	29.30	30.76
1971	18.84	0.39	1.50	1.01	0.86	1.28	26.79	28.13
1972	21.24	0.27	1.85	1.07	0.98	1.41	32.36	33.98
1973	28.27	0.31	2.07	1.96	1.26	1.53	45.40	47.67
1974	37.34	1.54	2.27	1.93	1.46	2.84	72.10	75.61
1975	36.30	5.75	2.18	2.31	1.48	2.03	78.22	82.13
1976	53.52	8.40	4.37	5.20	2.54	0.30	86.41	90.90
1977	102.05	23.23	4.40	10.35	4.20	0.39	126.41	132.99
1978	135.65	41.42	7.03	8.80	3.44	0.32	163.53	172.03
1979	204.86	89.32	7.90	12.40	8.21	0.82	262.52	275.65
1980	357.52	225.67	7.24	10.25	7.99	1.12	425.69	446.97
1981	474.34	338.35	7.38	8.20	8.47	1.13	562.04	590.14
1982	1,231.82	941.87	10.13	18.99	27.36	0.83	742.78	774.72
1983	2,592.85	1,822.04	14.14	61.56	46.75		923.45	972.39
1984	4,082.40	2,754.25	34.89	79.50	68.13		1,824.40	1,910.15
1985	5,705.12	3,799.90	23.51	139.57	92.05		3,306.00	3,461.38

Año	Exportaciones de Bienes (fob)	Importaciones de Bienes (fob)	Balanza Comercial	Otros Bienes, Servicios e Ingresos, Netos	Cuenta Corriente
-----millones de dólares-----					
1953	599	768	- 169	47	- 117
1954	668	760	- 92	69	- 29
1955	861	840	+ 21	133	+ 149
1956	844	1,018	- 174	60	- 116
1957	740	1,102	- 362	66	- 293
1958	752	1,090	- 338	73	- 264
1959	744	964	- 220	59	- 162
1960	778	1,132	- 354	35	- 324
1961	826	1,086	- 260	32	- 241
1962	930	1,097	- 167	-	- 182
1963	985	1,186	- 201	-	- 218
1964	1,054	1,424	- 370	- 42	- 423
1965	1,146	1,498	- 352	- 46	- 403
1966	1,244	1,581	- 337	- 54	- 392
1967	1,152	1,760	- 608	- 84	- 685
1968	1,258	1,892	- 634	- 122	- 743
1969	1,454	1,983	- 529	- 98	- 592
1970	1,348	2,236	- 888	- 235	- 1,068
1971	1,409	2,158	- 749	- 143	- 835
1972	1,717	2,610	- 894	- 87	- 916
1973	2,141	3,656	- 1,515	26	- 1,415
1974	2,999	5,791	- 2,791	- 206	- 2,876
1975	3,007	6,278	- 3,372	- 911	- 4,042
1976	3,475	5,771	- 2,295	- 1,269	- 3,409
1977	4,604	5,625	- 1,021	- 1,003	- 1,854
1978	6,246	7,992	- 1,745	- 1,618	- 3,171
1979	9,302	12,132	- 2,830	- 2,854	- 5,475
1980	16,241	18,896	- 2,655	- 5,607	- 8,162
1981	19,938	24,037	- 4,099	- 10,089	- 13,899
1982	21,230	14,435	+ 6,795	- 13,309	- 6,218
1983	22,312	8,550	+ 13,762	- 8,645	+ 5,419
1984	24,196	11,255	+ 12,941	- 9,112	+ 4,240
1985	21,867	13,460	+ 8,407	- 8,317	+ 540

Fuente: International Financial Statistics, Yearbook 1985, I.M.F.

Apéndice 2.1: Producto Bruto Interno Total y del Sector Primario, Desglosado en los Subsectores Agrícola, Pecuario, Silvícola y Pesquero, 1960-1985.

Año	PIB Global	PIB Agrícola	PIB Pecuario	PIB Silvícola	PIB Pesquero	PIB Sector Primario
	Precios en moneda constante de 1970 (millones)					
1960	218,006	21,422	11,538	1,278	481	34,719
1961	233,069	23,629	11,580	1,413	494	37,116
1962	242,499	25,476	11,393	1,532	510	38,910
1963	269,986	27,953	11,872	1,838	535	42,197
1964	312,198	31,550	12,931	1,823	466	46,770
1965	312,264	30,669	12,203	1,763	447	45,082
1966	332,412	29,703	12,203	1,690	502	44,098
1967	361,351	30,419	13,870	1,834	571	46,695
1968	390,720	30,523	14,054	1,843	561	46,982
1969	414,896	29,686	15,627	1,885	569	47,767
1970	418,700	29,726	15,071	1,963	675	47,435
1971	428,490	29,187	14,354	1,676	694	45,912
1972	456,677	29,210	15,250	1,716	966	47,143
1973	488,258	35,188	15,471	1,796	1,065	53,521
1974	522,138	37,528	13,649	1,840	1,077	54,093
1975	610,461	40,089	23,786	3,381	1,085	68,342
1976	636,978	39,468	23,761	3,499	1,201	67,928
1977	658,781	42,221	22,416	3,179	1,544	69,360
1978	712,795	43,673	24,229	3,098	2,058	73,058
1979	777,731	41,083	23,977	3,859	2,391	71,311
1980	842,476	42,781	21,638	3,649	2,287	70,355
1981	909,784	46,809	21,213	3,348	2,577	73,946
1982	904,515	41,887	19,039	3,211	2,456	66,593
1983	848,259	43,602	17,643	3,142	2,860	67,246
1984	865,719	48,003	20,248	3,685	2,710	74,646
1985 ^{a/}	911,544	50,241	29,968	3,154	2,660	86,023

Fuente: Sistema de Cuentas Nacionales de México, Secretaría de Programación y Presupuesto, varios años.

^{a/} Preliminar

Año	Total Prod. Agropecuarios Importados/Total Prod. Importados	Cereales Importados/Total Prod. Agropecuarios Importados	Total Prod. Agropecuarios Exportados/Total Prod. Exportados	Saldo de Balanza Comercial Agropecuaria (miles US\$)
		%		
1969	6.1	4.3	55.5	641,842
1970	9.3	30.3	54.2	478,228
1971	8.6	9.8	51.2	506,583
1972	9.2	31.0	47.2	592,927
1973	13.1	41.9	40.4	447,794
1974	18.0	46.6	37.2	- 30,479
1975	14.1	62.8	33.9	46,051
1976	9.3	22.1	40.1	746,113
1977	15.3	38.6	35.4	597,240
1978	12.8	35.0	27.5	700,464
1979	10.6	38.1	23.2	638,061
1980	16.0	36.4	11.2	- 1,264,933
1981	13.5	34.5	8.1	- 1,815,598
1982	12.8	24.0	6.6	- 532,252
1983	26.3	48.4	7.3	- 739,300
Promedios	13.0	33.6	31.9	487,711 (1969-79) - 1,088,021 (1980-83)

Fuente: Elaborado a partir de la publicación FAO, Trade Yearbook, 1984.

Apéndice 2.3. Maíz en México: Superficie Cosechada, Rendimiento Medio, Producción, Precio Medio Rural, Valor de la Producción, Comercio Exterior y Consumos Aparentes.

Año	Superficie Cosechada has	Rendimiento por ha kgs	Producción 000 ton	Precio Medio Rural \$/ton	Valor de Producción Millones \$	Comercio Exterior		Consumos	
						Importación 000 ton	Exportación 000 ton	Nacional 000 ton	Per-Capita kgs
1953	4,856,700	766	3,722	499	1,857	377	-	4,099	144
1954	5,252,779	854	4,488	515	2,310	147	-	4,634	157
1955	5,371,413	836	4,490	526	2,364	1	59	4,432	145
1956	5,459,588	803	4,382	636	2,786	119	1	4,500	143
1957	5,391,800	835	4,500	700	3,148	819	7	5,312	163
1958	6,371,520	828	5,277	709	3,743	810	-	6,087	181
1959	6,324,018	880	5,563	715	3,978	49	1	5,611	161
1960	5,558,429	975	5,420	729	3,949	28	457	4,991	138
1961	6,287,747	993	6,246	749	4,680	34	-	4,280	169
1962	6,371,704	995	6,337	762	4,828	18	4	6,351	165
1963	6,963,077	987	6,870	942	6,469	476	-	7,346	184
1964	7,460,627	1,133	8,454	945	7,990	46	283	8,218	199
1965	7,718,371	1,158	8,936	959	8,567	12	1,347	7,601	178
1966	8,286,935	1,119	9,271	918	8,508	5	852	8,424	191
1967	7,610,932	1,130	8,603	940	8,087	5	1,254	7,354	161
1968	7,675,845	1,181	9,061	934	8,467	6	897	8,171	173
1969	7,103,509	1,184	8,411	894	7,520	8	789	7,630	156
1970	7,439,684	1,194	8,879	905	8,035	762	3	9,639	190
1971	7,691,656	1,272	9,786	900	8,807	18	274	9,530	182
1972	7,292,180	1,265	9,223	902	8,318	204	426	9,001	166
1973	7,606,341	1,132	8,609	1,109	9,547	1,145	32	9,723	173
1974	6,717,234	1,168	7,848	1,463	11,481	1,282	2	9,128	157
1975	6,694,267	1,262	8,449	1,863	15,738	2,661	6	11,103	185
1976	6,783,184	1,182	8,017	2,167	17,373	914	4	8,927	144
1977	7,469,649	1,357	10,138	2,837	28,766	1,986	1	12,122	190
1978	7,191,128	1,520	10,930	2,912	31,830	1,419	2	12,347	188
1979	5,581,158	1,515	8,458	3,530	29,853	746	2	9,203	136
1980	6,776,479	1,829	12,374	5,019	62,107	4,187	-	16,561	239
1981	8,150,173	1,812	14,766	5,569	82,231	2,954	1	17,719	249
1982	5,703,633	1,779	10,147	8,614	87,408	253	1	10,399	142
1983	7,420,623	1,760	13,061	20,252	264,516	4,645		17,706	236
1984	7,042,746	1,830	12,890	34,689	447,141	2,428		15,318	199
1985	7,546,369	1,859	14,031	48,400 ^{a/}	679,100	1,675		15,706	200

Fuente: Econotecnia Agrícola: Consumos Aparentes de Productos Agrícolas, 1925-1982, Dirección General de Economía Agrícola, SARH, 1986.

^{a/} Corresponde al precio mínimo de garantía.

Valor de la Producción, Comercio Exterior y Consumo Aparentes.

Año	Superficie Cosechada has	Rendimiento por ha kgs	Producción 000 ton	Precio Medio Rural \$/ton	Valor de Producción Millones \$	Comercio Exterior		Consumos	
						Importación 000 ton	Exportación 000 ton	Nacional 000 ton	Per-Capita kgs
1958	119,812	1,304	156	533	83	4		160	5
1959	106,973	1,672	179	566	101	7		185	5
1960	116,432	1,797	209	636	133	9		219	6
1961	116,693	2,491	291	564	164	31		322	9
1962	117,637	2,516	296	558	165	59		355	9
1963	197,566	2,036	402	584	235	138		540	14
1964	276,494	1,901	526	601	316	21		546	13
1965	314,373	2,376	747	632	472	34		781	18
1966	575,860	2,450	1,411	639	902	23	35	1,399	32
1967	673,345	2,475	1,667	620	1,033	5	393	1,278	28
1968	829,719	2,570	2,133	622	1,326	61	166	2,027	43
1969	883,214	2,781	2,456	639	1,569	12	43	2,424	50
1970	920,930	2,829	2,747	646	1,774	26	44	2,729	54
1971	935,785	2,689	2,516	681	1,713	17	58	2,475	47
1972	1,108,972	2,355	2,612	736	1,922	246		2,858	53
1973	1,184,596	2,760	3,270	848	2,773	14	1	3,283	58
1974	1,155,746	3,028	3,499	1,268	4,438	427		3,926	68
1975	1,445,100	2,855	4,126	1,574	6,494	835		4,961	83
1976	1,251,130	3,219	4,027	1,660	6,683	45		4,071	66
1977	1,413,386	3,060	4,325	1,998	8,641	715		5,039	79
1978	1,399,296	2,997	4,193	2,246	9,419	753	1	4,945	75
1979	1,163,567	3,428	3,988	2,501	9,974	1,263		5,253	78
1980	1,543,092	3,039	4,689	3,485	16,343	2,254	2	6,941	100
1981	1,767,258	3,562	6,296	3,859	24,298	2,631		8,927	125
1982	1,340,072	3,699	4,956	5,324	26,389	2,479	8	7,435	102
1983	1,517,763	3,193	4,846	12,212	59,182	3,305		8,151	109
1984	1,624,196	3,084	5,009	20,698	103,676	2,747		7,756	101
1985	1,895,711	3,534	6,700	28,100	188,270				

Fuente: Econotecnia Agrícola: Consumos Aparentes de Productos Agrícolas, 1925-1982, Dirección General de Economía Agrícola, SARH, 1986.

Apéndice 2.5. Sorgo: Superficie Cosechada, Rendimiento y Volumen Producción en Distritos de Riego, Temporal y Total Nacional, 1960 - 1985.

Año	SUPERFICIE COSECHADA			RENDIMIENTOS			VOLUMEN DE LA PRODUCCION		
	Riego	Temporal	Total	Riego	Temporal	Total	Riego	Temporal	Total
	=====Hectáreas=====	=====Hectáreas=====	Nacional	=====Tons/Hectárea=====	=====Tons/Hectárea=====	Nacional	=====Toneladas=====	=====Toneladas=====	Nacional
1960	28,709	87,723	116,432	2.667	1.513	1.797	76,557	132,708	209,265
1961	86,768	29,925	116,693	2.215	3.290	2.491	192,184	98,457	290,641
1962	70,053	47,584	117,637	2.358	2.747	2.516	165,214	130,706	295,920
1963	128,886	68,680	197,566	2.236	1.660	2.036	288,157	114,026	402,183
1964	157,630	118,864	276,494	2.176	1.535	1.901	343,069	182,485	525,554
1965	115,347	199,026	314,373	2.764	2.152	2.376	318,722	428,222	746,994
1966	289,060	286,800	575,860	2.855	2.042	2.450	825,351	585,620	1,410,971
1967	247,015	426,330	673,345	2.930	2.212	2.475	723,676	942,945	1,666,621
1968	325,796	503,923	829,719	2.924	2.342	2.570	952,650	1,179,969	2,132,619
1969	322,775	560,439	883,214	3.430	2.407	2.781	1,107,165	1,348,763	2,455,928
1970	335,238	585,692	920,930	3.755	2.541	2.829	1,258,709	1,488,502	2,747,211
1971	317,627	618,158	935,785	3.839	2.098	2.689	1,219,242	1,296,716	2,515,958
1972	370,057	738,915	1,108,972	2.888	2.088	2.355	1,068,722	1,542,801	2,611,523
1973	428,251	756,345	1,184,596	3.931	2.098	2.760	1,683,350	1,586,486	3,269,836
1974	378,261	777,485	1,155,746	3.599	2.750	3.028	1,361,299	2,138,119	3,499,418
1975	469,623	975,477	1,445,100	3.444	2.572	2.855	1,617,310	2,508,508	4,125,818
1976	511,051	740,079	1,251,130	3.459	3.053	3.219	1,767,622	2,259,242	4,026,864
1977	414,577	988,809	1,413,386	3.940	2.695	3.060	1,633,523	2,691,445	4,324,968
1978	411,952	987,344	1,399,296	3.984	2.585	2.997	1,641,084	2,551,913	4,192,997
1979	548,339	615,228	1,163,567	4.293	2.657	3.428	2,354,027	1,634,396	3,988,423
1980	478,856	1,064,236	1,543,092	4.388	2.432	3.039	2,101,036	2,588,409	4,689,445
1981	589,962	1,094,472	1,684,435	4.432	3.172	3.613	2,614,709	3,471,781	6,086,490
1982	514,031	765,557	1,279,588	4.921	2.880	3.700	2,529,570	2,205,386	4,734,956
1983	544,241	968,944	1,513,185	4.493	2.457	3.189	2,445,760	2,380,798	4,826,554
1984	513,362	1,111,002	1,624,364	4.431	2.143	2.866	2,274,628	2,732,985	5,007,613
1985	603,911	1,287,410	1,891,321	4.306	3.138	3.511	2,600,666	4,040,015	6,640,681

Fuente: D.G.E.A., SARH, Dirección General de Granos y Oleaginosas de la SECOFI, y Dirección General de Política y Desarrollo Agropecuario y Forestal, SARH, 1986.

Índice 2.6. Principales Entidades Federativas Productoras de Sorgo, años 1980 y 1985.

<u>Entidad</u>	<u>Aporte a la Producción 1980</u>	<u>% del Total Nal.</u>	<u>Entidad</u>	<u>Aporte a la Producción 1985</u>	<u>% del Total Nal.</u>
Tamaulipas	1,462,365	30.39	Tamaulipas	2,346,817	35.34
Jalisco	961,952	19.99	Guanajuato	1,483,528	22.34
Guanajuato	877,424	18.23	Jalisco	907,781	13.67
Michoacán	549,405	11.42	Michoacán	623,566	9.39
Sinaloa	212,033	4.41	Sinaloa	372,542	5.61
Nuevo León	111,906	2.32	Coahuila	152,542	2.30
Morelos	93,348	1.92	Nayarit	125,509	1.89
Nayarit	86,165	1.79	Morelos	106,251	1.60
Chihuahua	70,731	1.47	Sonora	106,251	1.60
Querétaro	68,459	1.42	Nuevo León	104,259	1.57
Durango	65,853	1.37	Querétaro	83,672	1.26
Sonora	54,795	1.14	Durango	39,844	0.01
SUB-TOTAL	4,614,439	95.87		6,452,750	97.17
TOTAL NAL.	4,812,427	100		6,640,681	100

fuente: Elaboración propia en base a datos de CONASUPO en cifras y oficina de organización económica, Banco de México.

Apéndice 2.7. Compras Nacionales de Sorgo de CONASUPO y del Mercado Libre, e Importaciones de CONASUPO, 1960-1985

Año	Compras CONASUPO Nacionales (A)	% de Participación	Compras Mercado Libre Nales. (B)	% de Participación	Total Compras Nales. (A + B)	CONASUPO Import. (C)	% de Participación de Imp. en Compras CONASUPO	Compras Totales de CONASUPO (A + C)	Compras Totales (A+B+C)	% de Part. en Compras Totales
----- (Miles de Toneladas) -----										
1965	-	-	747	100.0	747	-	-	-	747	-
1966	210	14.9	1,201	85.1	1,411	12	5.4	222	1,423	15.6
1967	377	22.6	1,290	77.4	1,667	-	-	377	1,667	22.6
1968	275	12.9	1,858	87.1	2,133	39	12.4	314	2,172	14.4
1969	116	4.7	2,340	95.3	2,456	17	12.8	133	2,472	5.4
1970	190	6.9	2,557	93.1	2,747	12	6.0	202	2,759	7.3
1971	-	-	2,516	99.6	2,516	9	100.0	9	2,525	0.4
1972	7	1.2	2,606	99.8	2,612	221	96.9	228	2,833	8.0
1973	32	1.0	3,238	99.0	3,270	-	-	32	3,270	1.0
1974	35	1.0	3,465	99.0	3,500	474	93.1	509	3,974	12.8
1975	334	8.1	3,792	91.9	4,126	845	71.7	1,178	4,971	23.7
1976	483	2.0	3,544	88.0	4,027	-	-	483	4,027	12.0
1977	656	15.2	3,669	84.8	4,325	749	53.3	1,405	5,074	27.7
1978	571	13.6	2,622	86.4	4,193	922	61.8	1,493	5,115	29.2
1979	698	17.5	3,291	82.5	3,989	1,174	62.7	1,872	5,163	36.3
1980	345	7.4	4,395	92.6	4,690	1,340	79.5	1,685	6,030	27.9
1981	2,379	39.1	3,707	60.9	6,086	2,301	49.2	4,680	8,387	55.8
1982	1,208	23.1	4,016	76.9	5,224	1,371	53.2	2,579	6,595	39.1
1983	663	13.1	4,405	86.9	5,068	3,109	82.4	3,372	8,177	41.2
1984	1,122	19.1	4,766	80.9	5,888	3,265	84.0	4,415	9,153	48.2
1985	1,466	22.8	4,976	77.2	6,442	2,600	63.9	4,066	9,042	45.0

a/ Compras estimadas

Fuente: D.G.E.A., SARH, CONASUPO. Dirección General de Granos y Oleaginosas - SECOFI, 1986.

Apéndice 2.6 Evolución de las Producciones Físicas Totales de Carne de Res, Cerdo, Aves, y Leche, y sus Respectivos Precios Unitarios a Nivel del Productor Durante 1972-1984.

Año	Producción Carne Res en Canal (tons)	Precio Carne Res en Canal \$/ton	Producción Carne Cerdo en Canal (tons)	Precio Carne Cerdo en Canal \$/ton	Producción Carne Ave en Canal (tons)	Precio Carne Ave en Canal \$/ton	Producción Leche 000/lts	Precio Leche \$/litro
1972	706,970	12,520	572,864	11,418	215,485	17,316	4,916,259	2.08
1973	735,356	15,863	641,441	14,880	229,190	19,202	5,231,344	2.50
1974	746,172	19,552	719,037	19,623	248,075	21,969	5,550,435	3.12
1975	770,673	21,603	810,018	21,537	269,122	23,400	5,809,838	3.89
1976	845,431	23,667	909,310	23,561	288,811	26,846	5,907,348	4.15
1977	887,526	27,778	1,009,890	28,590	310,471	30,630	6,180,946	5.21
1978	948,247	40,880	1,084,622	42,540	335,682	37,490	6,398,599	5.91
1979	993,582	49,230	1,166,822	46,900	396,721	41,850	6,641,903	6.91
1980	1,065,075	54,036	1,250,800	43,023	449,000	46,836	6,505,811	8.46
1981	1,163,537	62,765	1,306,618	52,644	506,502	53,082	6,856,415	11.51
1982	1,200,544	105,625	1,367,414	115,836	520,182	98,449	6,923,597	16.13
1983	1,098,815	182,477	1,492,227	179,688	537,121	189,991	6,768,342	28.15
1984	1,046,432		1,438,420		583,524			

Fuente: Para cantidades: "Estadísticas Pecuarias", varios años, SARH; para 1983: "Agenda Agrícola 1983", Dirección General de Economía Agrícola, SARH. Para precios: "Estadísticas del Sector Pecuario de México"; para 1983, Agenda Agrícola 1983, Dirección General de Economía Agrícola, SARH.

Apéndice 2.9 Evaluación Social de la Producción de Sorgo en México Bajo Condiciones de Temporal, hacia Mediados de 1986.

<u>Ingresos Brutos/ha</u>	
3,100 kgs a \$78.18 = ...	Mex\$242,35
<u>Costo de Producción/ha</u>	
(a) Horas totales de tractor: 12 h. a 6,112.....	Mex\$ 73,34
(b) Semilla, 10 kgs a \$1,000.....	Mex\$ 10,00
(c) Fertilizante: 80 kg N a \$103,455/ton.....	Mex\$ 17,99
40 kg P ₂ O ₅ a \$ 84,130/ton.....	Mex\$ 7,31
(d) Herbicida; 3 kgs/ha Gesaprim.....	Mex\$ 10,03
(e) Insecticida: 500 c.c. Dipterex.....	Mex\$ 1,80
(f) Cosecha: 1 hora.....	Mex\$ 36,78
(g) Mano de Obra: 25 horas/ha, 2,000/día.....	Mex\$ 6,25
(h) Intereses: 8% sobre 2/3 costos, en 5 meses.....	Mex\$ 3,63
(i) Seguro Agrícola (6%).....	Mex\$ 10,03
(j) Imprevistos (5%).....	Mex\$ 8,86
Sub-Total	Mex\$186,05
(k) Flete del campo al destino final (\$5,850/ton).....	Mex\$ 18,13
Total	Mex\$204,19
Beneficio neto social/ha.....	Mex\$ 38,16
Relación Insumo/Producto.....	(84.3%)

Anexo 2.10 Evaluación Social de la Producción de Sorgo en México Bajo Condiciones
 de Riego, hacia Mediados de 1986.

<u>Ingresos Brutos/ha</u>	
4,300 kgs a \$78.18.....	Mex\$336,174
<u>Costo de Producción/ha</u>	
) Horas totales de tractor: 15 horas a \$6,112/h.....	Mex\$ 91,680
) Semilla, 10 kgs a \$1,000.....	Mex\$ 10,000
) Fertilizante: 120 kg N a \$103,455/ton.....	Mex\$ 26,988
40 kg P ₂ O ₅ a \$ 84,130/ton.....	Mex\$ 7,316
) Herbicida; 3 kgs/ha Gesaprim.....	Mex\$ 10,038
) Insecticida: 500 c.c. Dipterex.....	Mex\$ 1,809
) Riego: 3 riegos/ciclo.....	Mex\$ 40,500
) Cosecha: 1.3 hora.....	Mex\$ 47,817
) Mano de Obra: 45 horas/ha, \$1,800/día.....	Mex\$ 10,125
) Intereses: 8% sobre 2/3 costos, en 5 meses.....	Mex\$ 5,473
) Seguro Agrícola (6%).....	Mex\$ 15,105
) Imprevistos (5%).....	Mex\$ 13,345
	Sub-Total
	Mex\$280,194
) Flete del Campo al Destino final (\$5,850/ton).....	Mex\$ 25,155
	Total
	Mex\$305,349
Beneficio neto social/ha.....	Mex\$ 30,825
Relación Insumo/Producto.....	(90.8%)

Apéndice 3.1: Coeficientes Económicos y Técnicos Utilizados para los Principales Ingredientes Considerados en la Elaboración de Raciones Balanceadas.

	Sorgo	Yuca	Salvado Trigo	Giratina	Torta Cártamo	Torta Girasol	Torta Soya	Harinolina	Torta Pescado	Harina Alfalfa
Precio Unitario (Mex\$/kg)	80.4	63.0	98.0	97.0	87.0	92.03	170.0	149.32	266.43	89.62
Energía Metabolizable, Mcal/kg	3.20	3.20	1.15	1.90	1.15	1.50	2.20	1.90	2.78	1.25
Proteína (%)	8.70	2.00	15.0	35.0	20.0	28.0	46.0	43.0	61.0	18.0
Lisina (%)	0.22	0.10	0.61	1.40	0.60	1.20	2.80	1.65	4.92	0.80
Metionina-Cistina (%)	0.34	0.20	0.48	1.80	0.77	1.60	1.28	1.60	2.68	0.50
Metionina (%)	0.14	0.05	0.20	1.20	0.28	0.95	0.62	0.95	1.94	0.20
Fósforo Total (%)	0.25	0.15	1.22	1.00	0.60	1.00	0.62	1.00	2.75	0.25
Fósforo Digestible (%)	0.08	0.05	0.40	0.30	0.20	0.30	0.21	0.30	2.75	0.08
Calcio (%)	0.02	0.25	0.12	0.40	0.32	0.40	0.25	0.40	4.50	1.40
Fibra (%)	3.50	5.00	12.5	20.0	36.0	27.0	6.00	27.0	0.50	23.0
Grasa (%)	2.50	0.40	2.00	1.50	1.30	0.50	0.50	0.50	11.0	1.50

(Fuente: CIAT)

Tipo de Dieta	Yuca (%)	Sorgo (%)	Pasta Soya (%)	Otros (%)	Costo Total Dieta (\$)	Ponderación Dieta (%)
<u>A) Cerdos</u>						
a) Cerdo Iniciación (18%)	23.68	39.10	23.55	11.67	10,460.60	9.37
b) Cerdo Pre-Iniciación (21%)	36.44	7.77	38.27	17.52	10,921.15	0.94
c) Cerdo Crecimiento (16%)	0.00	72.85	17.50	9.65	9,746.51	12.90
d) Cerdo Desarrollo (14%)	12.15	64.43	12.43	10.99	9,119.75	17.17
e) Cerdo Finalizador (12%)	28.57	51.59	13.00	6.84	8,717.75	45.68
f) Cerdo Reproductor (15%)	15.84	49.67	5.00	29.49	8,341.68	13.94
<u>Promedio Ponderado</u>	19.91	54.69	13.59	11.63	9,051.08	
<u>B) Pollos de Engorda</u>						
a) Pollo Iniciación (21%)	13.46	44.93	19.64	21.97	11,965.12	35.0
b) Pollo Finalización (19.5%)	0.00	66.59	20.43	12.98	11,351.47	65.0
<u>Promedio Ponderado</u>	4.71	59.01	20.15	16.13	11,516.25	
<u>C) Aves de Postura</u>						
a) Ponedora Pollo Iniciación (20%)	0.00	59.71	21.17	19.12	11,155.38	10.20
b) Ponedora Pollo Crecimiento (16%)	0.00	66.33	12.86	20.81	9,492.48	8.20
c) Ponedora Polla Desarrollo (14%)	16.59	50.11	12.80	20.50	8,730.58	30.50
d) Gallina Ponedora Normal (16%)	0.00	67.67	12.98	19.35	9,642.36	42.50
e) Gallina Ponedora Fase 1 (18%)	0.00	51.98	9.57	38.45	10,936.14	5.80
f) Gallina Ponedora Reproductora (16%)	0.00	64.06	10.59	25.35	10,133.88	2.80
<u>Promedio Ponderado</u>	5.06	60.38	13.48	21.07	9,595.11	
<u>D) Ganado Lechero</u>						
a) Dieta 1	27.46	43.14	5.00	24.40	8,125.15	80.0
b) Dieta 2	28.32	25.77	5.00	40.91	8,627.87	20.0
<u>Promedio Ponderado</u>	27.63	39.67	5.00	27.70	8,225.69	

Apéndice 3.3: Rango de Precios de Ingredientes en Donde las Soluciones Permanecen Incambiadas (Estables).

Tipo de Dieta

A) Cerdos

	Yuca (\$)	Sorgo (\$)	Pasta Soya (\$)
a) Cerdo Iniciación (18%)	54.15 - 64.21	79.27 - 88.70	148.12-174.29
b) Cerdo Pre-Iniciación (21%)	55.23 - 66.13	77.58 - 87.48	162.23-174.72
c) Cerdo Crecimiento (16%)	60.86 - ∞	60.18 - 82.35	164.27-233.34
d) Cerdo Desarrollo (14%)	60.86 - 63.40	80.03 - 91.50	162.27-171.07
e) Cerdo Finalizador (12%)	60.86 - 63.40	80.03 - 82.35	149.32-171.07
f) Cerdo Reproductor (15%)	57.72 - 75.44	70.15 - 85.04	150.64- ∞
<u>Promedio Ponderado</u>	59.74 - 65.44	76.00 - 84.94	153.66-180.79

B) Pollos de Engorda

a) Pollo Iniciación (21%)	59.62 - 64.61	78.61 - 80.62	168.86-170.14
b) Pollo Finalización (19.5%)	56.14 - ∞	73.56 - 86.09	140.36-171.74
<u>Promedio Ponderado</u>	57.36 - 64.61	75.33 - 84.17	149.63-171.18

C) Aves de Postura

a) Ponedora Polla Iniciación (20%)	42.53 - ∞	63.02 - 97.97	41.35-227.87
b) Ponedora Polla Crecimiento (16%)	53.04 - ∞	74.49 - 88.85	152.90-213.15
c) Ponedora Polla Desarrollo (14%)	62.83 - 70.97	73.20 - 80.50	169.17-174.42
d) Gallina Ponedora Normal (16%)	56.14 - ∞	73.56 - 86.08	138.91-197.96
e) Gallina Ponedora Fase 1 (18%)	49.09 - ∞	68.06 - 92.35	85.24-179.50
f) Gallina Ponedora Reproductora (16%)	52.03 - ∞	68.66 - 88.61	119.50-179.50
<u>Promedio Ponderado</u>	56.01 - 70.97	71.99 - 86.25	135.68-193.44

D) Ganado Lechero

a) Dieta 1	58.98 - 67.20	76.80 - 83.84	130.65- ∞
b) Dieta 2	62.61 - 68.29	75.87 - 80.75	158.45- ∞
<u>Promedio Ponderado</u>	59.71 - 67.42	76.61 - 83.22	136.21- ∞

<u>Tipo de Dieta</u>	<u>Sorgo (%)</u>	<u>Pasta Soya (%)</u>	<u>Costo Total Dieta (\$)</u>	<u>Incremento Costo Respecto a Dieta con Yuca (%)</u>
<u>A) Cerdos</u>				
a) Cerdo Iniciación (18%)	65.39	17.34	10,503.02	0.70
b) Cerdo Pre-Iniciación (21%)	48.37	31.26	11,088.89	1.53
c) Cerdo Crecimiento (16%)	72.85	17.50	9,746.51	0.00
d) Cerdo Desarrollo (14%)	77.82	7.85	9,124.63	0.05
e) Cerdo Finalizador (12%)	82.70	5.00	8,786.18	0.78
f) Cerdo Reproductor (15%)	65.48	5.00	8,422.53	0.97
<u>Promedio Ponderado</u>	76.25	8.50	9,099.99	0.580
<u>B) Pollos de Engorda</u>				
a) Pollo Iniciación (21%)	62.38	14.99	11,987.13	0.18
b) Pollo Finalización (19.5%)	66.59	20.43	11,351.47	0.00
<u>Promedio Ponderado</u>	65.12	18.53	11,573.95	0.063
<u>C) Aves de Postura</u>				
a) Ponedora Polla Iniciación (20%)	59.71	21.17	11,155.38	0.00
b) Ponedora Polla Crecimiento (16%)	66.33	12.86	9,942.48	0.00
c) Ponedora Polla Desarrollo (14%)	68.49	9.29	8,730.58	0.37
d) Gallina Ponedora Normal (16%)	67.67	12.98	9,642.36	0.00
e) Gallina Ponedora Fase 1 (18)	51.98	9.57	10,936.14	0.00
f) Gallina Ponedora Reproductora (16%)	54.06	10.59	10,133.88	0.00
<u>Promedio Ponderado</u>	65.71	12.42	9,632.01	0.113
<u>D) Ganado Lechero</u>				
a) Dieta 1	73.53	5.00	8,141.69	0.20
b) Dieta 2	56.91	5.00	8,627.90	0.003
<u>Promedio Ponderado</u>	71.80	5.00	8,238.93	0.161

Apéndice 3.5: Cambios Potenciales en la Demanda por Yuca, Sorgo, y Pasta de Soya, si la Yuca Estuviera Ampliamente Disponible por la Industria de Alimentos Concentrados.

I) Total Nacional de Producción de Alimentos Balanceados en 1984:
8:500,000 tons

a) <u>Demanda del Sector Porcícola (29%)</u>	= 2:465,000 tons
i) demanda de yuca (19.91%)	= 490,782 tons
ii) ahorro en sorgo (76.25-54.69%)	
21.56%	
21.56% de 2:465,000	= 531,454 tons
iii) incremento de pasta de soya	
(13.59-8.50%)=5.09%	
5.09% de 2:465,000	= 125,468 tons
b) <u>Demanda del Sector de Pollos de Engorda</u> (18.1%)	= 1:538,500 tons
i) demanda de yuca (4.71%)	= 72,463 tons
ii) ahorro en sorgo (65.12-59.01%) =	
6.11%	
6.11% de 1:538,500	= 94,002 tons
iii) incremento de pasta de soya	
(20.15-18.53%) = 1.62%	
1.62% de 1:538,500	= 24,924 tons
c) <u>Demanda del Sector Aves de Postura</u> (35.1%)	= 2:983,500 tons
i) demanda de yuca (5.06%)	= 150,965 tons
ii) ahorro en sorgo (65.71-60.38%)	
= 5.33%	
5.33% de 2:983,500	= 159,021 tons
iii) incremento de pasta de soya	
(13.48-12.42%) = 1.06%	
1.06% de = 2:983,500	= 31,625 tons
d) <u>Demanda del Sector Ganado Lechero</u> (11.80%)	= 1:003,520 tons
i) demanda de yuca (27.63%)	= 277,273 tons
ii) ahorro en sorgo (71.80-39.67%)	
= 32.13%	
32.13% de 1:003,520	= 322,431 tons
iii) incremento de pasta de soya	
(5.00-5.00%) = 0.00	
0.00 de 1:003,520	= 0.00

(continuación)

II) Resumen del Comportamiento Esperado del Sector Porcícola, Avícola y Ganado Lechero, Según Cifras de Alimentos Balanceados en 1984 (94% del total industrial).

a)	Demanda de yuca	:	991,483 tons
b)	Ahorro en Sorgo	:	1:106,908 tons
c)	Incremento de Pasta de Soya	:	182,017 tons

III) Resumen del Comportamiento Esperado de la Totalidad de la Industria de Alimentos Balanceados Según Cifras de 1984.

a)	Demanda de Yuca	:	1:056,117 tons
	Area estimada a plantar	:	183,060 has
b)	Ahorro de Sorgo	:	1:179,067 tons
c)	Incremento en Pasta de Soya	:	193,826 tons
d)	Beneficio Neto en el Comercio Exterior en términos de Sorgo y Pasta de Soya en 1984		
	i) Precio Sorgo c.i.f. México ^{1/}	:	US\$107.07 /ton
	ii) Precio Pasta de Soya c.i.f. México ^{1/}	:	US\$185.70 /ton
	iii) Ahorro en Sorgo	:	US\$118:516,640
	iv) Incremento en Pasta de Soya	:	US\$ 33:800,557
	Beneficio Neto	:	US\$ 84:716,083

IV) Proyecciones de la Demanda Potencial de Yuca para 1984
Suponiendo una Tasa de Crecimiento Anual Promedio del 4.0% en la Demanda de Concentrados, la Demanda Potencial de Yuca para 1990 Será:

a)	Demanda de concentrados 1990 (8:500,000) x T.C. promedio anual de (1.04) ⁶ = 1.265	=	10:752,500 tons
b)	Demanda de yuca 1990 (1:056,117 x 1.265) Area estimada a plantar (1:335,988 x 2.6% 15)	=	1:335,988 tons 231,571 has

^{1/}: Commodity Price Data, Commodity Studies and Projections Division
Economic Analysis and Projections Department, Economics and
Research Staff World Bank.

(continuación)

-
- c) Ahorro en Sorgo
(1:179,067 x 1.265) = 1:491,520 tons
- d) Incremento en Pasta de Soya
(193,826 x 1.265) = 245,190 tons
- e) Beneficio Neto para 1990
Suponiendo que los precios permanecieran constantes y/o la
relación de precios entre el sorgo y la pasta de soya no
cambia, el beneficio neto será:

- i) Beneficio Neto en el Comercio Exterior
en Términos de Sorgo y Pasta de Soya
en 1990
- ii) Precio sorgo c.i.f. México : US\$107.07/ton
- iii) Precio pasta de soya c.i.f. México : US\$185.70/ton
- iv) Ahorro de sorgo : US\$159:697,046
- v) Incremento en pasta de soya : US\$ 45:531,783

Beneficio Neto : US\$114:165,263
=====

EL POTENCIAL DE LA YUCA EN PANAMA
Y SUS RELACIONES CON EL RESTO
DE LA ECONOMIA

Dr. Roberto R. Saez
CIAT - Programa Yuca Economía
Diciembre, 1986.

INDICE

	Página
Resumen y Conclusiones	i
A) Aspectos Macroeconómicos	1
B) El Sector Agropecuario	5
1) Importancia Relativa del Sector Primario y su Balanza Comercial	5
2) Comportamiento de los Subsectores Agrícola y Pecuario (Oferta)	7
3) Demanda de Productos Agropecuarios en General, y de la Yuca Fresca en Particular	10
C) El Cultivo de la Yuca en Panamá (Oferta)	14
1) Características Generales	14
2) Costos-Beneficios-Rentabilidad Privada de la Producción y Procesamiento del Cultivo de Yuca, en Relación al Maíz y el Sorgo	21
3) Medidas de Incentivo a la Producción Nacional de Maíz, Sorgo y Yuca en Panamá	24
4) Medidas de Rentabilidad Social y de Ventajas Comparativas	32
D) Demanda Potencial de Yuca Deshidratada por Parte de la Industria Avícola Tecnificada de Panamá	38
1) Soluciones Óptimas de Mínimo Costo	39
2) Análisis de Sensibilidad en las Dietas con Incorporación de Yuca	43
3) Estimación de la Demanda Potencial de Yuca con Destino a la Producción de Balanceados, y su Impacto sobre los Principales Ingredientes Tradicionales	45
Referencias y Lecturas Adicionales	48
Apéndices	50

Cassava Potential in Panama and Its Relationship with the Rest of the Economy

Roberto R. Saez
22 January, 1987

Summary and Conclusions

The economy of Panama was characterized by a healthy growth pattern until 1973, especially a lack of inflationary problems and an increasing share of public and private gross fixed capital formation in its Gross Domestic Product (GDP). However, since then several macroeconomic parameters started to deteriorate: (a) the growth rate for the GDP between 1974-85 has fallen to only 3.4% annually, (b) government consumption of goods and services has reached very high proportions leading to rising fiscal deficits, (c) the economy developed a weak export capacity, and (d) the current account of the balance of payments showed negative balances throughout most of the period. Consequently, in addition to the need to rationalize public sector expenditures, Panama needs to promote exports of competitive goods and/or look for efficient import substitutes whenever the country proves to have a comparative advantage, thus allowing better utilization of its domestic resources.

The agricultural sector in the aggregate has been growing at rates below the other sectors, which explains the consistent reduction in its share within total GDP. This drop in the relative weight of the primary sector was more dramatic than the reduction in total rural labor; thus, gross income per capita in agriculture is only a fraction of the other

sectors of the economy. Although the agricultural trade balance has historically been positive, these have been small in magnitude and more recently they have been getting even smaller, and/or turned negative. The number of primary foods exported are few in number (i.e., mainly bananas, sugar, and coffee), while agricultural commodities that the country is obligated to import are maize, beef and dairy products.

Growth in production in the majority of agricultural commodities in Panama has been below population growth, with a few exceptions: coffee, tabacco, shrimp, sorghum, poultry and eggs, and to a lesser extent pork. By contrast, for commodities like beans and cassava, their production growth have been negative during the last decade. Average productivity is low in general for both crop and livestock sectors, which implies that improved technological practices are not being utilized by farmers. It is argued in this paper that some of the causes for this situation are the skewed land distribution, as well as ineffective research, extension, and agricultural credit programs; on the other hand, internal price policies for most primary products are quite favorable to farmers, compared to international prices.

Commodities that clearly have shown rapid expansion over the last two decades are pasteurized milk, poultry, and eggs, which has allowed the proportion of protein from animal origin in the diet to increase significantly. By contrast, per capita demand for cereals has dropped slightly, and even more strongly has been the reduction in fresh cassava consumed. Roots and tubers supply an average of 3.5 per cent of total calorie intake by the population, cassava being the principal item within

that category with a 50 per cent share. Own price elasticity in the cassava demand equation for the total population (rural and urban) was estimated as -0.34, while the income elasticity was 0.54. Given these parameters, it is concluded that although fresh cassava demand is relatively inelastic to a change in relative prices, this root is seen in Panama as a "normal" good due to its positive income elasticity. Assuming population and real income growth equivalent to historical trends (1960-83), by 1990 it can be expected that 4,694 additional tons of fresh cassava will be demanded. Moreover, if the effect of a drop of 1 per cent per year in its real price is included, 1,136 tons more will be demanded. Consequently, this scenario gives only a modest expansion in total demand for fresh roots, amounting to 5,830 tons a year.

Cassava is cultivated by numerous farm units but in very small plots per farm, and (not surprisely) at low yield levels. Only 20 per cent of the national supply actually reaches the market due to high on-farm utilization. The small proportion of fresh cassava that is marketed takes place under wide marketing margins, even higher than other roots like potatoes and yams, even though little value-added is incorporated except transportation and wholesale-retailing activities. When a representative sample of cassava producers was surveyed from the province with highest proportion of commercially oriented farmers, significant differences with respect to national average parameters were detected; i.e. a larger scale of production (2-3 has planted per farm), greater utilization of modern inputs, higher yields (13.5 tons/ha), and 86 per cent of total production being marketed. However, basic production constraints to this group that are common to the majority of cassava farmers were also detected: (a) lack

of sufficient hired labor during critical periods and of mechanization services to plant larger areas, (b) no credit support, (c) seasonal price instability for the product which implies that the final market can be saturated whenever significant quantities of fresh roots arrives in a short period of time, and (d) inefficient marketing channels to transport the roots based on small trucks and no application of post-harvesting conservation techniques to control deterioration. All these factors lead to reduced opportunities for fresh cassava to have greater impact in Panama's economic development.

When private profitability at the farm level is calculated for maize, sorghum, and cassava, highly positive net benefit levels are found, with cassava having the highest (i.e., 31.1% net income per year over a land and capital investment of US\$500/ha). These estimates were derived using improved technological packages which implied that to break-even farmers would need to harvest 3.09 tons/ha in maize, 3.16 tons/ha in sorghum, and 13.1 tons/ha in cassava. When drying and transportation costs are added to production costs, the price of dried cassava represents 82.5 per cent of the price of sorghum, and 74.9% of maize.

However, the above private profitability measurements are achieved with the help of artificial trade barriers. This is apparent when computing the effective protection coefficient (EPC) for the three of them, being 2.3 for cereals and 1.6 for dried cassava. Moving one step further, DRC estimates were also computed, reaching the magnitudes of 1.07, 1.08, and 1.24 for grain sorghum, dried cassava, and maize, respectively. Thus, although from a socially efficient point of view these commodities show

negative profitabilities; in the first two cases these rates are only marginally unprofitable. They could be turned positive by slight increases in international prices for feed grains (or cassava), some modifications in production practices, etc. This author feels there are no strong arguments against encouraging the internal supply of both grain sorghum and cassava in Panama, whenever efficient technologies already available and verified by farmers in Herrera province are selected.

The last subject under investigation in this paper was deriving estimates of demand potential for dried cassava by animal feed factories, which in turn are closely linked with the poultry sector in the country. The optimal solution or minimum cost found in balanced feed diets indicates that cassava chips can enter in those mixtures with 20 and 30 per cent shares for broilers and layers, respectively. The inclusion of cassava in feed formulation will demand an increased utilization of protein sources (between 4-7.6 per cent more) to keep a constant nutritional content; however, average ration unit costs are still cheaper by 1.7 to 3.1 per cent. The optimal solutions appear to be stable with respect to relative price increases in cassava up to the point that the price for cassava reaches 81 and 89 per cent of the cost of maize and sorghum, respectively. Demand projections for dried cassava for 1990 indicate an estimate of 37,900 tons a year, implying 7,300 has of additional land be planted to cassava (this land may be coming out of extensive cattle operations, sugar cane, and other less profitable activities). Following this strategy Panama could earn foreign exchange savings of US\$6.6 million by reducing maize imports, a benefit that is added to the internal reduction in feed ration costs (approximately US\$1.1 million), although the country should

increase the importation of US\$1.8 million of protein sources like maize gluten, soybean meal, etc.

In summary, this study concludes that although fresh cassava is considered a normal good in Panama, the biggest demand potential for this crop in the near future is found as an input in animal feed rations. Having observed high private profitability rates in both cassava production and processing, this situation neither offsets its competitiveness with respect to cereals when used by the poultry sector, nor is inconsistent with national objectives. Thus, the public sector should be promoting the implementation of pilot projects in order to capture the benefits being anticipated. At the same time improvements in marketing efficiency for fresh cassava by means of post-harvest techniques are recommended which together with larger trucks could significantly reduce the price spread between farmers and consumers.

EL POTENCIAL DE LA YUCA EN PANAMA Y SUS RELACIONES CON EL RESTO DE LA ECONOMIA

Resumen y Conclusiones

La economía de Panamá se ha caracterizado por presentar un crecimiento muy saludable hasta 1973, por no tener ningún problema inflacionario al conducir el país una política monetaria neutra en el circulante, así como verificar una mayor participación de las inversiones públicas y privadas dentro de su Producto Bruto Interno (PIB). Sin embargo, hay evidencias de la ocurrencia de dificultades ya que: (a) el crecimiento de su PIB entre 1974-85 se redujo a un promedio de solo 3.4% anual, (b) el gasto corriente del sector público ha avanzado a niveles desproporcionados, derivándose en la acumulación de importantes déficits fiscales, (c) su economía exhibe una muy débil capacidad exportadora de bienes, y (d) el saldo en la Cuenta Corriente de su Balanza de Pagos todavía verifica significativos montos negativos. Consecuentemente, en adición a la necesidad de racionalizar el gasto público, se impone en Panamá un fomento a las actividades exportadoras de bienes competitivos en mercados internacionales, y/o la sustitución eficiente de otros bienes en donde el país exhiba ventajas comparativas para su reemplazo, mediante una mejor utilización de sus recursos internos.

Por su parte, el sector agropecuario en su conjunto ha estado creciendo por debajo de los demás sectores económicos, con lo que su participación dentro del PIB ha venido cayendo sistemáticamente. Dado que esta caída en la contribución relativa del agro fue más severa que la reducción de mano de obra ocupada en el campo, los ingresos brutos per cápita de la población rural son una fracción del correspondiente a las demás ramas económicas. La balanza comercial agropecuaria (exportaciones menos importaciones de origen agropecuario) si bien históricamente ha evidenciado saldos positivos, éstos han sido muy bajos en valores monetarios, pero con el agravante de que los mismos han

tendido a decrecer y/o ser negativos en años recientes. Las ventas al exterior están basadas en muy pocos productos (ej., banana, azúcar y café), mientras que entre los rubros deficitarios que el país se ve obligado a importar se encuentran el maíz, productos cárnicos y lácteos.

Para la mayoría de los principales productos agropecuarios sus respectivas ofertas internas han estado evolucionando por debajo del crecimiento poblacional experimentado por el país, encontrándose entre las pocas excepciones las siguientes: café, tabaco, camarón, sorgo, avicultura (huevos y pollo), y en menor grado la porcicultura. Incluso en rubros como el frijol y la yuca sus crecimientos han sido negativos durante la última década. Asimismo, los rendimientos físicos promedios a nivel nacional son muy bajos en la casi totalidad de los rubros agrícolas y pecuarios, lo cual evidencia la aplicación de niveles tecnológicos no acordes a las reales necesidades de la nación. Son argumentados en este trabajo como los causantes a dichos problemas a una inadecuada distribución del recurso tierra, así como a una escasa efectividad de los apoyos de investigación, extensión y crédito agrícola que el productor medio efectivamente logra recibir; por el contrario, las políticas de precios internos a los productos primarios se entienden que no han sido desfavorables para el agricultor.

Por el lado de la demanda interna por productos agropecuarios sobresalen los crecimientos experimentados en el consumo de leche pasteurizada, huevo, y carne de ave entre 1960 y 1983, con lo que las proporciones de proteínas de origen animal han venido aumentando rápidamente en la dieta panameña. En contraposición, la demanda directa per cápita en el consumo de cereales han venido cayendo ligeramente, pero más fuertemente se verificó una caída en el consumo de yuca fresca. La totalidad del consumo de raíces y tubérculos aportan en promedio un 3.5% de las calorías totales ingeridas por su población, siendo la yuca el componente principal dentro de esta categoría con casi un 50% de participación. La elasticidad precio propio en la ecuación de demanda de yuca fue estimada para la totalidad de su población en -0.34, mientras que el efecto ingreso real se situó en 0.54. Con ello se concluye que si bien la respuesta de parte del consumidor de yuca fresca

es relativamente inelástica a un cambio en el precio del producto, esta raíz es vista en Panamá como un bien normal al ser positiva su elasticidad ingreso. Suponiendo que los crecimientos de la población total y del ingreso real per cápita continúen experimentando las mismas tendencias que durante el período 1960-83, hacia 1990 cabría esperar una demanda efectiva adicional en el consumo de yuca fresca del orden de las 4,694 tons. A su vez, si a este efecto se le añade una caída en el precio real de la yuca a nivel del consumidor en un 1% anual, se podría añadir unas 1,136 tons más. Consecuentemente, bajo este escenario solo se debería esperar un modesto incremento en la demanda (oferta) total de yuca fresca, en unas 5,830 tons anuales.

El cultivo de la yuca es practicada por numerosos productores pero es sembrado en muy pequeñas cantidades por predio, consiguiéndose en promedio bajos rendimientos físicos unitarios. Solo un 20% de la oferta nacional de esta raíz llega efectivamente al mercado debido a su importante autoconsumo en la misma finca. Esta escasa proporción vendida fuera del predio se lleva a cabo dentro de amplios márgenes de comercialización, aún superiores a los experimentados por otras "raíces" como la papa y el ñame, a pesar de que no se le incorpora al producto ningún tipo de transformación que no sea simplemente su traslado a las zonas urbanas y la intervención de intermediarios mayoristas y minoristas. Al analizar una muestra representativa de productores yuqueros provenientes de la provincia con mayor enfoque comercial del cultivo, se detectaron diferencias significativas respecto a la media nacional en términos de: escala de producción (2-3 has sembradas/predio), utilización de insumos modernos (fertilizantes, herbicidas), rendimientos alcanzados (13.5 tons/ha) y destino del producto obtenido (96% es comercializado). A pesar de ello se ratificó la incidencia de las mismas restricciones a la producción para este grupo de agricultores que las que se argumentaran afectan a la totalidad del universo de yuqueros: (a) falta de mano de obra contratada en períodos críticos, (b) de servicios de mecanización para trabajar una mayor área a ser sembrada, (c) de crédito agrícola, (d) inestabilidad de precios del producto y de continuidad en la capacidad de absorción durante el año por parte de los mercados finales del bien en estado fresco, y (e)

ineficiencias en el mecanismo de comercialización por transportarse el producto en unidades de pequeño tamaño, y no aplicarse ningún procedimiento de conservación post-cosecha del producto fresco a fin de reducir su deterioro. Por todos estos motivos se estarían frenando las oportunidades de una posible mayor contribución de la yuca al desarrollo agropecuario de Panamá.

Al comparar las rentabilidades privadas a nivel del productor de los cereales maíz y sorgo en relación con la yuca, se encontró en todos los casos niveles de beneficios netos muy competitivos, siendo la yuca la que exhibe la mayor tasa de los tres (ej., 31.1% anual sobre la base de un capital en tierra requerido de US\$500/ha). Estas estimaciones fueron derivadas utilizando niveles tecnológicos elevados ya que para cubrir los costos totales de producción se necesitaría de rendimientos unitarios de 3.09 tons/ha en maíz, 3.16 tons/ha en sorgo, y 13.1 tons/ha en yuca. Cuando se añade a los costos de producción las partidas por secamiento de la yuca y su transporte a la ciudad de Panamá se arriba a un costo/ton de yuca seca a ser potencialmente utilizada por la industria del alimento balanceado, y/o las empresas avícolas modernas, el cual representa un 82.5% del precio del sorgo puesto en dicho lugar, y un 74.0% del de maíz en las mismas condiciones.

Sin embargo, toda esta economía privada para estos tres rubros (y presumiblemente para una proporción significativa de muchas de las restantes actividades agropecuarias) se lleva a cabo dentro de un marco de protección artificial muy fuerte por parte de las políticas de precios del Gobierno de Panamá, la cual hace posible aquellas altas rentabilidades. Ello se comprueba al computarse el coeficiente efectivo de protección (CEP) para los tres productos bajo estudio, ya que cuando tales bienes se utilizan como ingredientes en raciones balanceadas se arriba aun CEP de 2.3 para los cereales y de 1.61 para la yuca. Llevando a cabo un paso más en el análisis se arribó a que los DRC para el sorgo y la yuca son de 1.07 y 1.08 respectivamente, siendo para el maíz de 1.24. Con ello se concluye que si bien desde un punto de vista social todos estos productos presentan rentabilidades negativas, en los dos primeros casos éstas son ligeras con lo que fácilmente

podrían convertirse en positivas de producirse leves ascensos en los precios internacionales respectivos, y/o pequeños cambios en las técnicas de producción, y/o supuestos utilizados para la construcción de sus presupuestos. De esta manera no existirían argumentos suficientes como para desestimular al menos las producciones de sorgo y de yuca dentro de la economía, en la medida que se apliquen paquetes tecnológicos eficientes ya disponibles y probados por un número importante de productores de la Provincia de Herrera.

El último punto investigado en este trabajo consistió en la determinación de la demanda potencial de yuca deshidratada por parte de la industria del alimento balanceado de Panamá, la cual está estrechamente vinculada con las necesidades del sector avícola moderno. Las soluciones óptimas de mínimo costo encontradas en la preparación de dietas balanceadas para pollos de engorda (PE) y aves ponedoras (AP) sitúan a la harina de yuca con una concentración de 20% y 30% de participación, respectivamente. Esta inclusión de yuca en las mezclas exigiría sin embargo, la adición de 4% más de fuentes proteicas en PE y 7.6% en AP, a pesar de lo cual el costo medio de la ración se abatiría en 3.1% y 1.7% para PE y AP, respectivamente. Las soluciones arriba reportadas para yuca resultan estables a pesar de que su propio precio a nivel de fábrica se acerque a un 81% del precio del maíz, y a un 89% del precio del sorgo. Al proyectar las necesidades de la industria avícola y del concentrado de Panamá hacia 1990, se deriva una estimación de 37,900 tons de yuca seca a ser potencialmente demandada, lo cual implicaría producir cuando menos 95,000 tons de yuca fresca a ser obtenida de 7,300 has de superficie. Con ello el país podría ahorrar US\$6.6 millones por concepto de la no adquisición de maíz del exterior, beneficio éste que se agregaría a la disminución de los costos de los ingredientes de la ración (US\$1.1 millones), siendo ellos neutralizados en parte por la importación de US\$1.8 millones de fuentes proteicas adicionales (ej., gluten de maíz, pasta de soya, etc).

Consecuentemente, este estudio concluye que a pesar de que la yuca fresca es considerada en Panamá como un bien normal, el gran potencial de demanda por esta raíz en los años venideros se encuentra en su

utilización como materia prima en la fabricación de alimentos balanceados animales. Habiéndose verificado rentabilidades privadas elevadas en la faz de producción-procesamiento de la yuca, hecho éste que no neutraliza su competitividad respecto a los cereales a nivel de fabricante de concentrados, ni es incompatible con objetivos de carácter nacional, el sector oficial debería promover la realización de este tipo de proyectos pilotos en donde se demuestren los resultados que están siendo anticipados y de esta forma fomentar una actividad intensiva en ocupación de mano de obra. Al mismo tiempo es altamente recomendable mejorar los niveles de eficiencia en la comercialización del producto en estado fresco mediante las nuevas técnicas de conservación post-cosecha, estrategia ésta que podría estar asociada con la movilización del producto a los centros urbanos en camiones de mayor tamaño, como forma de abaratar aún más los márgenes de comercialización.

EL POTENCIAL DE LA YUCA EN PANAMA Y SUS RELACIONES CON EL RESTO DE LA ECONOMIA

Este trabajo resume las investigaciones relativas a la economía del cultivo de yuca en Panamá durante los dos últimos años, como parte de un proyecto del CIAT que involucrara a este autor en varios países de Mesoamérica. El presente documento intenta cuantificar las reales posibilidades de esta raíz en el país, verificando los incentivos privados y sociales que tiene dicha actividad como condición esencial para la generación de una oferta comercial suficiente que satisfaga la demanda potencial agregada que oportunamente fuera detectada dentro de la industria de alimentos concentrados, así como en el mercado tradicional de yuca fresca. Durante el proceso de derivación de estos resultados fue también necesario clarificar los vínculos directos e indirectos que tiene la yuca con los demás sectores económicos, para de esta forma resaltar aún más su importancia estratégica.

A) Aspectos Macroeconómicos

La economía panameña ha venido creciendo durante las últimas tres décadas a una tasa continua del 5.5% anual, con lo que desde 1953 a 1985 su tamaño real casi se sextuplicó. Sin embargo, al descontar a dicho avance el crecimiento poblacional durante este período, es posible verificar que los ingresos medios per cápita se reducen a una tasa del 2.6% anual, por lo que el típico ciudadano de Panamá debía esperar algo más de 27 años para comprobar una duplicación en el poder adquisitivo de sus ingresos. A pesar de que solo en dos años se detectaron reducciones en el valor del PIB total real (ej., 1976 y 1984), en términos per cápita aparecen más años en donde los avances económicos no fueron suficientes como para superar el crecimiento poblacional (ej., 1958, 1974-76, y 1983-84). Consecuentemente, es posible dividir dos períodos muy marcados en el comportamiento de la economía de Panamá ya que mientras en las dos primeras décadas (1953-73) el crecimiento económico se ubicaba en un índice del 6.6% anual, durante los últimos 13 años el

progreso económico bajaba a la mitad (3.3%). Hacia 1985 el PIB real per cápita se ubicaba en un 3.4% por debajo de su valor máximo histórico alcanzado en 1982 (US\$1,917.2) (Apéndice 1.1). A continuación se procederá a estudiar algunos de los parámetros macroeconómicos más relevantes a los efectos de poder interpretar a través de ellos, las políticas económicas ejecutadas en el país.

En primer lugar llama la atención la gran expansión experimentada por el Sector Público, particularmente en su componente de gasto corriente, el cual de tener una participación del 8.8% del PIB en 1953, pasó a ser 22.5% en 1982, para decrecer al 19.4% en 1984. Por su parte la categoría de Inversiones Fijas Públicas y Privadas también creció en forma muy significativa, pues representando en 1953 en 11.5% del PIB alcanzó un máximo absoluto y relativo en 1982 con 27.7%, para luego caer a 17.9% en 1984. Estos dos parámetros macroeconómicos aumentaron su participación a expensas de una importante caída en el Consumo Privado. Finalmente la contribución de las Exportaciones-Importaciones en la formación del PIB se mantiene aproximadamente constante a lo largo de los años. Con todo cabe destacar el muy alto porcentaje que representan las relaciones internacionales en la generación de bienes y servicios totales del país (ej., promedio 1953-84, exportaciones: 39.1% del PIB; importaciones: 43.0%).

En el Apéndice 1.2 se observa más directamente la eficiencia del funcionamiento del aparato público de Panamá (política fiscal), al cuantificarse los recursos reales que contó el gobierno para enfrentar sus programas de gastos e inversiones. En este sentido destacan los continuos déficits presupuestales al situarse los ingresos públicos en solamente un 80.9% de los egresos entre 1953 y 1984. Es posible dividir en varios subperíodos el comportamiento de los desequilibrios de las finanzas públicas al exhibir éstas niveles muy diferentes entre sí. Así, durante la primera mitad (1953-68) los déficits representaban un relativo pequeño porcentaje del PIB total (1.3%), siendo los ingresos percibidos por el Estado un 91.2% de los egresos totales. Sin embargo entre 1969 y 1982 el exceso del gasto público sube muy rápidamente, para ubicarse en un 6.9% del PIB, con los ingresos significando solamente un

72.6% de los egresos. Sin duda que esta situación no podría continuar indefinidamente, por lo que el gobierno entre 1983-85 contrajo el gasto público significativamente (particularmente la inversión), al tiempo que los ingresos se mantenían aproximadamente iguales (relación ingreso/gasto: 96.6%). Con ello los déficits se ubican nuevamente en un 1.2% del PIB.

A pesar de que seguramente aquella contracción del gasto público explicó en gran medida que el PIB total no creciera lo suficiente entre 1983-84, es preferible en el mediano y largo plazo esta situación de recesión económica temporaria, si con ello se restablece un saneamiento de las finanzas públicas. Sin embargo, este equilibrio parcial detectado últimamente en el presupuesto público, en realidad fue a expensas de un excesivo recorte de la inversión pública, por lo que sería preferible si se pudiera conseguir disminuciones más importantes en el gasto corriente, para no perjudicar los niveles de inversiones productivas. Una severa limitación a esta última propuesta es que simplemente el poder dar servicio a la creciente deuda pública acumulada durante todo el período (en 1985 ascendía a US\$3.3 billones), debe explicar un alto porcentaje del gasto corriente, por lo que las reducciones deberían venir por otros conceptos que no impidan cumplir al Estado con sus servicios esenciales. Consecuentemente quizás no haya otra forma que aumentar las tasas impositiva, y/o reducir la evasión fiscal, y/o incorporar un mayor número de contribuyentes al fisco.

Por la peculiar situación de Panamá de haber adoptado como moneda nacional el dolar americano, ello determina que no pueda tener y aplicar políticas monetarias típicas de aquellos países en donde sí se tiene completa independencia en materia de circulación monetaria. Concretamente, ello le imposibilita el no tener la capacidad de emitir dinero circulante, quedándole sin embargo otros mecanismos para hacer variar la masa monetaria como por ejemplo, mediante el cambio en las tasas de interés, y/o por medio de la compra/venta de instrumentos de deuda pública. La verificación de esto es que el circulante real monetario de Panamá entre 1953 y 1984 estuvo muy en relación con la real capacidad de crecimiento de toda la economía (8.6% vs 5.6%, respectivamente), hecho

éste que no es típico de muchas economías en vías de desarrollo en donde al comprobar déficit presupuestales crecientes, uno de los procedimientos para su financiación es la emisión monetaria (Apéndice 1.3). Como consecuencia de ello el nivel de precios al consumidor en Panamá creció a tasas incluso inferiores a las verificadas en EEUU (2.9% vs 4.3% respectivamente, entre 1953 y 1985) (Apéndice 1.4). La inflación definitivamente, no es un problema en la economía panameña.

En lo que tiene que ver con la balanza comercial se aprecia que los volúmenes monetarios de importaciones de bienes a nivel cif explican en promedio un 84.3% de los montos de importaciones registradas en los cuadros de Cuentas Nacionales, con la diferencia explicada por concepto de servicios de importaciones que el país se viera obligado a contratar. Por el contrario, las exportaciones de mercancías de todo tipo solo contribuyeron con un 24.8% de las exportaciones computadas en las Cuentas Nacionales. De ahí se deduce que los servicios de exportación de Panamá constituyen el grueso de su comercio exterior en materia de ventas. Más importante aún es constatar el enorme desbalance entre bienes exportados e importados que sistemáticamente se ha generado durante las tres últimas décadas. Entre 1953 y 1984 las ventas de mercancías al exterior solo representaron un 26.7% de los bienes importados. Cuatro productos explican 76% de las ventas al exterior (ej., bananas: 32.4%, petróleo refinado 21.7%, camarón: 12.3% y azúcar: 9.5%), siendo el petróleo crudo uno de los insumos más significativos dentro de las importaciones (23.8%). De los rubros exportados antes citados, solo el camarón ha logrado mantener e incluso acrecentar su participación relativa dentro de las ventas al exterior; todas las demás categorías las han reducido (Apéndice 1.5).

Una medida más amplia que la balanza comercial a efectos de medir las relaciones internacionales de una economía en su Balanza de Pagos. En ella se incluye en adición al comercio neto en divisas por la compra-venta de mercancías, el flujo neto de servicios, servicios de la deuda externa, turismo, pago de patentes, etc. En el Apéndice 1.6 se comprueba nuevamente los importantes saldos negativos de la balanza comercial de bienes del país, los cuales suman acumulativamente en 30

años la cantidad de -US\$9,833 miles. Sin embargo, este importante monto desfavorable está balanceado parcialmente por el superávit en la cuenta neta de servicios como habíamos visto anteriormente, con lo que en definitiva se arriba a un desequilibrio en la Cuenta Corriente del orden de -US\$2,108 miles acumulados entre 1955 y 1985. (79% de este déficit se explica durante el período 1973-80). Como indicio favorable en las perspectivas futuras del país, se puede apreciar que durante los últimos cinco años (1981-85) la Cuenta Corriente evidencia un saldo positivo acumulado de US\$203 millones.

Resumiendo entonces, se puede concluir que Panamá se ha caracterizado por presentar un crecimiento muy saludable en su economía hasta 1973, en no tener ningún problema inflacionario al conducir una política monetaria neutra en el circulante, así como una creciente participación de las inversiones públicas y privadas dentro de su PIB. Sin embargo, hay evidencias de la ocurrencia de dificultades ya que: (a) el crecimiento de su PIB entre 1974-85 se redujo a solo 3.4% anual, (b) el gasto corriente del sector público ha avanzado a niveles desproporcionados, (c) como lógica derivación de (b), se han venido acumulando importantes déficits fiscales, (d) una muy débil capacidad exportadora de bienes, y (e) un saldo en la Cuenta Corriente de la Balanza de Pagos que todavía exhibe importantes montos negativos. En adición a la necesidad de racionalizar el gasto público, se impone consecuentemente un fomento a las actividades exportadoras de bienes competitivos en mercados internacionales, y/o en la sustitución eficiente de otros bienes con potencial de reemplazo mediante una mejor utilización de sus recursos internos.

B) El Sector Agropecuario

1) Importancia Relativa del Sector Primario y su Balanza Comercial.

Consistente con el fenómeno generalizado de todo proceso de desarrollo económico en el sentido de que el sector agropecuario va perdiendo participación relativa dentro del PIB total, Panamá manifestó

precisamente esta situación al pasar de un 27.2% en 1950/52 a solo 11.9% en 1983. En contraposición, el sector comercio y servicios explicaba un 66.5% del PIB en 1983, al incluirse las actividades relacionadas con el área del Canal de Panamá. Asociado con el fenómeno anterior es posible verificar una disminución absoluta y relativa de la población económicamente activa en el sector primario (ej., 160,200 personas en 1970; 148,400 en 1980), lo cual a su vez favoreció a que otros sectores tuvieran disponibles una mayor cantidad de este importante factor de producción. A pesar de ello, más de un 25% de la población activa se encuentra en el agro, con lo que se desprende que cualquier estrategia de crecimiento económico que el país seleccione deberá incorporar necesariamente a su sector primario. Dado que la caída en la participación del agro dentro del PIB fue más severa que la reducción de mano de obra ocupada en el campo, sus ingresos brutos per cápita solo representaban un 41% de los correspondientes a las demás ramas económicas hacia 1980 (Apéndice 2.1).

Dentro del PIB agropecuario destacó sobremanera el subsector agrícola el cual hasta 1980 explicaba un 75% del mismo, a pesar del relativo bajo porcentaje de utilización del suelo bajo condiciones de cultivo. Sin embargo, desde el comienzo de la presente década, el sector pecuario ha venido ganando terreno relativamente (28.3% en 1984) pero no lo suficiente como para justificar la gran cantidad de tierra bajo su control (Apéndice 2.2).

En lo que tiene que ver con la balanza comercial agropecuaria es posible constatar que las exportaciones del sector primario explican un 50% de las ventas promedio de bienes al exterior entre 1969 y 1983, mientras que solo requiere de un 9% de las importaciones totales. Con todo el balance neto de divisas del sector apenas si representó una media de US\$38.9 millones anuales en dicho período, el cual significa solo un 1.7% del PIB total del país. En adición se evidencia claramente que las importaciones han venido progresando más rápidamente que las exportaciones, por lo que hacia años recientes los saldos del comercio exterior agropecuario han tendido a decrecer, y/o ser negativos. Con respecto a la composición de las ventas al exterior se verifica una

concentración excesiva en muy pocos productos (ej., bananas, azúcar y café con 87.6% de participación entre 1969 y 1983), así como una aportación mínima en productos de origen pecuario. La única excepción a la falta de dinamismo de las exportaciones de productos primarios se encuentra en el sector pesquero, con las ventas al exterior principalmente de camarones. Las mismas han crecido a un ritmo del 14.5% anual en términos de valor comercializado, llegando a representar los productos pesqueros un 24% de las exportaciones de bienes totales del país en 1983. Por su parte, las importaciones agropecuarias de mayor significación dentro del presente estudio son las de maíz (promedio: 35,000 ton anuales y US\$6 millones), productos cárnicos (US\$8.1 millones anuales) y lácteos (US\$11.7 millones anuales) en los últimos años. En términos globales se puede afirmar que el país se ha caracterizado durante la última década de ser altamente dependiente del exterior para el abastecimiento de las calorías, proteínas y grasas que requiere su población, en el orden de 33.5%, 29.8% y 49.5%, respectivamente (Apéndices 2.3, 2.4, 2.5, y 2.6).

2) Comportamiento de los Subsectores Agrícola y Pecuario (Oferta)

En primer lugar es importante consignar que en base a la información censal de 1980, resulta clara la existencia de una muy defectuosa distribución del recurso tierra en Panamá, al ocupar dos terceras partes de los productores agropecuarios un área de menos del 4% del total trabajado, y en el otro extremo, un 2.7% de las explotaciones tienen control de cerca del 50% de la tierra utilizada. Mientras el primer grupo deriva una media de superficie por explotación del 1.7 has, el segundo controla 268 has por predio. Aún admitiendo diferencias en productividad física y localización (accesos) a los principales mercados del país, aparece como muy desigual el uso del suelo a nivel nacional. De poderse comprobar esta hipótesis sería muy conveniente la aplicación de algún tipo de impuesto a la productividad mínima exigible de la tierra que se ocupa, a efectos de estimular la intensificación del uso de la misma. De la misma fuente de información antes citada se desprende también la rápida caída de la superficie bajo cultivo con el aumento del área total de la unidad de explotación. Razones de este

fenómeno se hipotizan en el sentido de una relativa escasez de mano de obra en periodos críticos, y/o a la falta de una apropiada mecanización (Saez, 1986 a/).

En 1980 los tres cultivos que más área cosechada ocupaban eran el arroz (92,474 has), caña de azúcar (53,373 has), y maíz (52,184 has). Un segundo grupo de actividades agrícolas estaban representadas por el sorgo, yuca y frijol con 8,808 has, 7,127 has, y 7,448 has, respectivamente, para quedar en tercer lugar cultivos como el poroto, guandú, ñame y tabaco (promedio de este grupo: 2,609 has cosechadas). El cultivo que ocupa más área promedio por predio es el sorgo con casi 13 has, seguido de la caña de azúcar con 3.6 has, y todos los demás explicando menores áreas respecto a las magnitudes anteriores. Otra característica que sobresale de las cifras del censo agropecuario de ese año son los bajos rendimientos físicos obtenidos en los principales cultivos, como por ejemplo: i) caña de azúcar: 38.6 tons/ha, ii) sorgo: 2.2 tons/ha, iii) arroz: 1.8 tons/ha, iv) yuca: 3.4 tons/ha, v) maíz: 1.0 tons/ha, y vi) frijol: 0.3 tons/ha. Seguramente que al no proporcionársele una asistencia técnica y crediticia adecuada a la enorme mayoría del agro panameño, ello no está ayudando para que se alcancen niveles de eficiencia productiva superiores a los citados. Por su parte, los porcentajes comercializados de productos agrícolas en el país difieren sustancialmente entre los diversos bienes. Así, mientras que las producciones de sorgo y banano que efectivamente llegan al mercado final son del orden del 95% de la oferta nacional, la yuca solo contribuye con un 20.5% de su total generado. A su vez, las ventas combinadas de ñame y yuca aportan en los ingresos de dinero en efectivo del productor solo un 1.3% de las ventas agrícolas totales de 1980 (Apéndices 2.7-2.10).

Aunque no pudo ser cuantificado, algo similar debe ocurrir en el sector ganadero de carne y leche, actividades éstas practicadas por medianos y grandes productores a los que se les debería también apoyar, pero al mismo tiempo exigir, una mayor productividad en sus explotaciones (Apéndice 2.11). No menos importante resulta el hecho de que se debería acrecentar las inversiones en superficie agrícola bajo riego las cuales al presente se ubican en las 30,000 has a nivel nacional (en caña

de azúcar: 14,000 has, arroz: 7,000 has, bananos: 9,000 has). Prioridades por este tipo de obras deberían estar basadas en proyectos de pequeña y mediana escala, los cuales en general tienen mayores posibilidades de éxito en su operacionalidad que los de gran escala.

Durante el período 1974-83 los aumentos de los volúmenes de producción fueron razonablemente favorables solamente en los cultivos de café, sorgo y tabaco, y en el sector pecuario en avicultura y porcicultura. En todas las demás actividades (ej., caña de azúcar, maíz, arroz, frijol, yuca, ñame, plátano, banana, carne de res y leche), los crecimientos han estado por debajo del aumento poblacional. Incluso, para el caso de la yuca y el frijol sus evoluciones en el tiempo han sido negativas. La marcha de los precios corrientes internos recibidos a nivel de finca por los productores han estado ajustándose por debajo del proceso inflacionario del país, por lo que en términos reales el poder adquisitivo por unidad de producto cayó durante la última década. El producto menos desfavorecido en este sentido fue el maíz, a pesar de lo cual su producción solo aumentó en un 1.6% anual. La relación de precios maíz/arroz se hizo más desfavorable a este último, con lo que la producción de arroz apenas si creció a un 1.2% anual. En el caso de la avicultura, su menor ritmo de crecimiento en los precios recibidos estuvo más que compensado por incrementos en su productividad, con lo que el ingreso real para este productor se mantuvo favorable (Apéndices 2.12-2.14).

Consecuentemente, la mayoría de los principales productos del sector agrícola han mostrado una pobre evolución no acordes a las necesidades de crecimiento económico que el sector agropecuario especialmente debe exhibir para aumentar los ingresos per cápita de su población, y/o disminuir la migración rural hacia los centros urbanos, los cuales seguramente no tienen la capacidad suficiente para absorber productivamente este exceso de mano de obra.

3) Demanda de Productos Agropecuarios en General, y de Yuca Fresca en Particular.

El Apéndice 3.1 nos ilustra los muy importantes avances en los consumos per cápita de leche pasteurizada (aunque no de lácteos totales), huevo, y carne de ave que ha experimentado Panamá entre 1960 y 1983, los que han crecido a una tasa promedio del 4.65% anual. Por el contrario, los cereales: trigo, arroz, y maíz, colectivamente han visto disminuida su demanda per cápita en dicho período a una tasa de -1.45% anual, ya que a la insuficiente producción interna de los mismos se asociaron niveles de importaciones no suficientemente elevados como para mantener constante la demanda total.

En particular, el producto yuca fresca si bien durante la totalidad del período creció a un ritmo del 1.09% anual, restringiendo nuestro análisis al subperíodo 1970-83 dicha raíz cayó en los consumos individuales a razón del -4.3% anual (de 22.0 kg per cápita y por año en 1970, a 12.2 kg en 1983). La totalidad del consumo de raíces y tubérculos aportan en promedio un 3.5% de las calorías totales ingeridas por su población, siendo la yuca el componente principal dentro de esta categoría con un 48.9% de participación (Apéndice 3.2). La pérdida en consumo per cápita constatada en yuca determina que para recuperar los niveles alcanzados a comienzos de los '70 se debería producir adicionalmente un volumen de 11,600 tons en 1983, o sea un 34% más de la producción verificada en dicho año, o un total de 50,000 tons de yuca fresca. Los niveles presentes de consumo de yuca en Panamá si bien son superiores a los constatados en países como México, Costa Rica y Jamaica, se encuentra significativamente por debajo de los correspondientes a República Dominicana, Haití, Paraguay y Brasil por ejemplo, dentro del contexto latinoamericano.

Por el lado de los consumos de proteínas totales es posible observar que un 55.8% tienen origen vegetal y un 44.2% origen animal como media del período 1960-1981. Sin embargo es notoria la caída en participación relativa de las proteínas de origen vegetal en la dieta panameña, las cuales se deslizaron desde un máximo de 63.4% a principios

de los '60, a solo 51.4% entre 1979 y 1981. En términos absolutos el promedio de consumos de proteínas totales a comienzos de los '80 era de 56.4 grs diarios per cápita, cifra ésta que se encuentra 16% por debajo de la media latinoamericana (FAO, 1984). Los cereales explican la mayor fuente proteica para la población con una participación del 41%, seguida por la contribución de todas las carnes (27.3%), productos lácteos (10.4%) y huevo (2.9%). Los consumos per cápita de carne de res, cerdo, pollo y huevo han venido aumentando para ubicarse en 1983 en 25.2 kgs, 3.3 kgs, 11.0 kg y 8.1 kg por año, los cuales en su conjunto son bastante comparables a los de otros países de la región. En cambio, los consumos de fuentes proteicas derivadas de productos lácteos totales sí se encuentran a niveles inferior a los de otros países en similar estado de desarrollo (35.8 kgs per cápita y por año).

Coincidiendo con los productos que evidenciaron mayores incrementos de consumo per cápita, los precios reales de leche pasteurizada, huevos y carne de ave son también los que han descendido más rápidamente entre 1960 y 1985, a una tasa del 2.41% anual. Ello significa que hacia 1985 los precios reales de estas fuentes proteicas animales se encontraban a casi la mitad de lo vigente en 1960. Este factor, sumado al efecto de un mejoramiento de los ingresos per cápita reales de la población (2.82% anual), y al propio crecimiento poblacional (2.97% anual) ha inducido a que la demanda total por productos avícolas aumentara a un 7.52% anual, y la de leche pasteurizada en un 8.24% anual. En contraposición, la carne de res y de cerdo que en sus consumos per cápita crecieron en forma muy moderada, se han visto asociados con incrementos en sus respectivos precios reales también en forma moderada (Apéndice 3.3).

En lo que tiene que ver con el precio de yuca al consumidor, ésta decreció en términos reales a razón de un 1.17% anual entre 1960-85, tasa ésta superior en valor absoluto a la experimentada por la papa y el plátano, y en oposición al incremento verificado en el precio real del ñame. Comparando los niveles de precios de yuca al consumidor con el que recibe el productor de esta raíz en su finca se comprueba un elevado margen de comercialización, en el sentido de que el agricultor solo realiza un 28.7% del precio final entre 1979-83, en comparación con un

35.5% del productor de ñame, y un 38.9% de el de papa. Dada esta relativa ineficiencia en los procesos de comercialización para la yuca, ello conduce a que se vean reducidas a nivel del consumidor las ventajas del menor precio que remunera los esfuerzos del productor yuquero, a pesar de lo cual hacia 1985 el precio de la yuca para el consumidor final era un 35.6% del precio ñame, un 34.3% de el de papa, y un 9.7% del precio del banano, por unidad de peso.

Complementando los aspectos descriptivos de las principales variables de consumo en los artículos seleccionados como representativos de la dieta panameña, toca ahora hacer un esfuerzo adicional por analizar el comportamiento del consumidor promedio del país (esto es, la media ponderada del ubicado en zonas rurales y urbanas), enfrentando los precios reales de sus respectivos bienes, así como también estimando los efectos del cambio en sus ingresos reales y, dado nuestro interés particular, el efecto "precio cruzado" de la yuca (para el caso de la función de demanda de la yuca, los precios cruzados seleccionados fueron ñame y papa).

Las formas funcionales empíricas uniecuacionales experimentadas utilizando el procedimiento de mínimos cuadrados ordinarios fueron la: (i) lineal, y (ii) doble logarítmica, con la variante de la incorporación o no del precio cruzado. Si bien fueron corridos los modelos correspondientes a los once posibles productos, solamente se reportan seis de ellos pues en los casos de la papa, plátano, ñame, trigo, y arroz, dichas ecuaciones evidencian R^2 muy bajos, y/o sus signos asociados con el efecto propio son contrarios a lo esperado. Los resultados obtenidos se presentan en detalle en los Apéndices 3.4 - 3.9.

De los seis grupos de funciones de demanda reportadas, las correspondiente a la de carne de cerdo aparecen como las más pobres desde el punto de vista del grado de ajuste a los datos utilizados (ej., medido por el coeficiente del R^2). Por su parte, las ecuaciones de yuca evidencian moderados grados de ajuste, mientras que las de leche pasteurizada, huevo, carne de res y de pollo son las que mejor ajuste exhiben (prom.: $R^2 = 0.813$).

Los efectos precios propios encontrados aparecen como fuertes en los productos carne de cerdo, pollo y leche, y moderados en los demás artículos. En particular para el caso de la yuca la elasticidad de su precio es del orden de -0.335 en la ecuación con mayor R^2 , lo cual significa que la respuesta en términos de su demanda es relativamente inelástica a un cambio en su precio real (ej., frente a una caída de un 10% en el precio real de la yuca, todo lo demás constante, cabría esperar un aumento en su demanda del orden de un 3.4%).

En lo que tiene que ver con la elasticidad precio cruzada de la yuca sobre los cinco productos animales antes citados, sus efectos son lógicamente aún más bajos en términos absolutos, con la excepción de la demanda por carne de pollo en donde la yuca se comporta como un relativo fuerte sustituto (elasticidad promedio: +0.696). De acuerdo con estos resultados la yuca es también sustituto de la leche pasteurizada y de la carne de res (elasticidad prom.: +0.153), y como un bien complementario para el consumo de huevo y carne de cerdo (elasticidad prom., -0.152). A su vez, en la ecuación de la yuca los productos ñame y papa se verifican como complementarios del consumo de yuca, con elasticidades de -0.68 y -1.195 respectivamente.

Finalmente, el efecto ingreso real tiene una elevada incidencia en los artículos leche pasteurizada, huevo y carne de pollo, y moderado en los demás rubros. Lo más significativo dentro de este factor es el efecto positivo del ingreso sobre el consumo de yuca para el promedio de población (elasticidad: 0.540). Con ello se verifica que la yuca es en Panamá como un bien normal, y no inferior como frecuentemente cita en la literatura. De haberse podido separar los consumos y precios de la yuca para la población rural exclusivamente, dicha elasticidad seguramente habría sido aún más fuerte.

Entre los beneficios a obtener del proceso de estimación de funciones de demanda se encuentra la proyección futura de los consumos del bien en cuestión. Para ello lógicamente se deben plantear diversos escenarios sobre posibles comportamientos de las variables independientes. Así, para el caso de la yuca, suponiendo los mismos crecimientos

de la población y del ingreso real per cápita como los experimentados desde 1960 a 1983, hacia 1990 cabría esperar un incremento del consumo de yuca fresca del orden de las 4,694 tons adicionales. Si a este efecto se le añade una caída en el precio real de la yuca de un 1% anual, se podría añadir unas 1,136 tons de consumo adicional, todo lo cual nos lleva a una expansión estimada en la demanda hacia 1990 de 5,830 tons.

C) El Cultivo de la Yuca en Panamá (Oferta)

1) Características Generales

Como ya se adelantara en páginas anteriores, el cultivo de la yuca es practicado por numerosos productores de Panamá con la característica de que es sembrado en muy pequeñas cantidades por predio. Según el censo agropecuario de 1980, el promedio de área cosechada en las seis principales provincias agrícolas del país era de 0.12 has/predio. En términos de indicadores de productividad, las provincias de Coclé y Veraguas se sitúan en los niveles de rendimientos unitarios máximos con 5,208 kgs/ha y 4,913 kgs/ha, respectivamente. Al combinar los componentes superficie cosechada y rendimientos unitarios, nuevamente resultan aquellas dos provincias como las que aportan más significativamente en la oferta interna, seguidas por Panamá y Herrera. Sin embargo, dado que los porcentajes de yuca comercializada fluctúan grandemente entre provincias, Herrera pasa a ser la más importante en cuanto a su participación en los mercados finales (28.0%), seguida de Panamá (19.6%), Chiriquí (16.6%), y Veraguas (9.2%).

A efectos de conocer más profundamente las características técnico-productivas del cultivo de yuca en su faz comercial en el país, se condujo en marzo de 1984 una encuesta a 40 productores en la provincia de Herrera (Distrito de Ocú), como parte de un esfuerzo colaborativo del IDIAP y el CIAT. Las mayores responsabilidades de esta investigación en materia de organización, conducción y procesamiento estuvieron a cargo de los Ings. Miguel Ríos y José Aguilar, ambos técnicos del IDIAP, quienes reportaron oportunamente dichos resultados. Los siguientes

párrafos intentan resumir los principales puntos detectados por los autores antes nombrados.

En primer lugar, llama la atención el significativo tamaño de las explotaciones agrícola-ganaderas encuestadas dentro de una muestra representativa de esta región, en donde la yuca tiene un cierto grado de importancia dentro de ellas. Así, la media aritmética de superficie total por predio nos sitúa en las 42 has (27% con menos de 10 has, 25% entre 10 y 30 has, y 48% con más de 30 has). A pesar de esta importante área disponible en dichas explotaciones, la yuca en monocultivo es sembrada en solamente 2.05 has, y en asociación con ñame, maíz, arroz, guandú, etc, en 1.00 ha. Otros cultivos y áreas en descanso representan un 11.7% del predio, siendo el restante 81% dedicado a la actividad de ganadería doble propósito (carne y leche) de carácter extensivo. Consecuentemente, aquí se verifica lo mencionado previamente al analizar los datos del Censo Agropecuario del '80, en el sentido de la rápida caída relativa de los rubros agrícolas al aumentar el tamaño de superficie por predio. Ello nos induce a pensar nuevamente en la existencia de limitaciones del tipo de una insuficiente disponibilidad de mano de obra contratada durante períodos críticos, y/o de servicios de mecanización, y/o de crédito agrícola, como factores restrictivos de un uso más intensivo del suelo. En adición, en el caso de la yuca su tope máximo de superficie sembrada (5-7% del predio) pudiera también indicar la existencia de inestabilidades de precios y/o de insuficiente capacidad de absorción en los mercados finales para este producto en estado fresco, todo lo cual lleva a que el agricultor minimice el riesgo de un posible fracaso económico mediante una siembra limitada en superficie.

Un 57.7% de los productores siembran yuca en monocultivo, con 35% en asociación con los cultivos antes citados, y un 7.3% practican ambos sistemas. La asociación que más área ocupa es la de yuca-maíz, seguida por la de ñame, arroz y guandú. Por su parte, mientras los cereales arroz y maíz son sembrados con destino a satisfacer las necesidades de autoconsumo familiar, los de ñame, otoo, guandú y caña de azúcar son comercializados en su gran mayoría. A su vez, mientras los cereales son

practicados en explotaciones con muy escasos recursos de capital, lo que conlleva que sus niveles tecnológicos seleccionados son de una muy baja utilización de insumos modernos, a los demás cultivos se les dedican más recursos al ser conducidos por productores relativamente más fuertes económicamente. En este sentido, el ñame atrae mucho la atención del agricultor por gozar esta raíz de un precio cuatro veces superior al de la yuca, de un mercado seguro, y de no estar sujeta a deterioro importante durante el proceso de su comercialización.

En lo que tiene que ver con la actividad mayoritaria de estos predios, esto es la producción ganadera de doble propósito, ésta tiene mayor significación lógicamente en los predios de más de 10 has. Llama la atención que los niveles tecnológicos practicados sean muy bajos al caracterizarse la producción lechera por tener un carácter estacional muy marcado coincidente con el período de lluvias de la región (junio a diciembre). La base forrajera está fundamentada en pasturas naturales las que no generan excedentes forrajeros suficientes como para que se los transfiera a la estación de menor disponibilidad de pastos. En adición, aún admitiendo que no sea sembrada una mayor cantidad de yuca en estas explotaciones para ser comercializadas como frescas en los mercados urbanos dados los riesgos inherentes ya conocidos, sería interesante determinar el por qué de la no integración vertical de las producciones de yuca y de leche dentro de los predios. De esta forma se podría aumentar la disponibilidad energética de las vacas durante su pico de máxima producción, para de esta manera hacer durar un tanto más su ciclo productivo, y/o suplementar moderadamente a las vacas en estado seco para que no pierdan condición física y así poder más rápidamente entrar en un nuevo ciclo productivo con el inicio de las lluvias, y/o suplementar las categorías en crecimiento de reposición para que también ellas se integren antes en su faz productiva. Sería importante diagnosticar si estas prácticas no son aplicadas por el productor por no ser rentables las mismas, o por un desconocimiento de su existencia, y/o por la incidencia de algún tipo de restricción en disponibilidad de recursos productivos. La gran ventaja de conducir la actividad lechera por parte de estos productores no es tanto por la rentabilidad económica en sí, dado que su baja productividad física presente condiciona una

baja eficiencia económica, sino la de generar la suficiente liquidez financiera con la venta continua de un producto de fácil colocación en el mercado local, con lo que permite sobrellevar mejor los gastos de producción y familiares durante más de medio año.

Entrando más específicamente en la tecnología de la producción de yuca se comprobó que un 85% de los productores preparan mecánicamente el suelo que será destinado a la siembra de yuca. La época de preparación fluctúa entre marzo y septiembre, aunque son más frecuentes los meses de abril y mayo. La preparación más tardía de la tierra y consecuentemente su siembra más tardía se ve justificada por algunos productores a los efectos de obtener un mejor precio por su producto al momento de su comercialización, pero ello también implica que los rendimientos unitarios deben caer al perderse gran parte del período favorables de lluvias. Por su parte, un pequeño porcentaje de productores utilizan el sistema de labranza mínima al aplicar el herbicida Gramoxone (dosis: 3.9 lts/ha) para limpiar el terreno previo a su siembra. Esta última práctica es llevada a cabo fundamentalmente por agricultores de escaso tamaño que no cuentan con las facilidades de una preparación mecánica de su tierra.

Inmediatamente de terminada la preparación del suelo comienza la siembra de las estacas. Un 75% de los productores utilizan sus propias semillas las que fueran guardadas del ciclo anterior; los restantes las obtienen de productores vecinos. Se detectó que el productor da adecuada importancia a la selección de estacas en función de su aspecto físico como ser el no tener daños mecánicos visibles, ser vigorosas, provenir de partes maduras de la planta, etc, así como tener un tamaño cercano a los 20 cms; sin embargo, el productor no trata químicamente su estaca. Las siembras se practican en plano, con una densidad de plantas de 8,300/ha cuando el cultivo se siembra en monocultivo (1.20 x 1.00), y 6,900 plantas/ha cuando se asocia con maíz (aún menores densidades se utilizan cuando se asocia con ñame). Solo un 31% de los agricultores reportan sembrar en cultivo puro las 10,000 plantas/ha que es normalmente lo recomendable. Finalmente, mientras las siembras yuca-maíz se realizan simultáneamente, en el asocio yuca ñame se siembra primero el

ñame (mayo), para después hacer lo propio con la yuca.

Un 70% de los productores fertilizan el cultivo, aunque a muy bajas dosis (45.00 kg/ha de la fórmula 12-24-12), entre los 22 y 60 días luego de sembrada la yuca en monocultivo. Para hacer un uso más eficiente del fertilizante, éste es ubicado a un lado de la planta. Sin embargo, cuando la yuca es sembrada en asociación con ñame, la concentración de fertilizante casi se cuadruplica en relación a la dosis antes mencionada, mientras que si se la asocia con maíz la misma se reduce a la mitad.

Más de la mitad de los productores (60%) controlan las malezas mediante una combinación de herbicida y deshierbe manuales (dos). Cuando se aplica producto químico, este es Gramoxone a razón de 2.5-4.5 lts/ha aplicado entre los 20-60 días de efectuadas las siembras, teniendo cuidado que dicho producto no entre en contacto con las plántulas de yuca. Los que no utilizan herbicidas (40%) de cualquier manera siguen realizando dos limpiezas durante el ciclo del cultivo. Sin embargo, cuando no se aplica herbicida la cantidad de jornales requeridos para realizar estas operaciones son de 26.6/ha, mientras que aplicando un control químico los requerimientos de mano de obra se reducen a 16.1 jornales/ha. Cuando la yuca es asociada al ñame los herbicidas seleccionados son una combinación de Gesapax y 2-4-D (4.1 lt y 3.2 lt/ha, respectivamente) aplicado al voleo entre los 8-15 días después de la siembra.

En materia de plagas y enfermedades, un 42% de los agricultores detectaron ataque de insectos (ej., gusano cachón, y la arriera [*Atta* sp]), pero de este grupo solo la tercera parte efectuó algún tipo de control (químico). El restante 58% simplemente no percibió daño alguno. En lo que tiene que ver con la incidencia de enfermedades, solo 5% fueron consciente de ello al detectar daños por pudrición de la raíz y por bacteriosis. Únicamente cuando se practica la asociación yuca-ñame y surge la presencia de antracnosis en las plantas de ñame, sí los productores están dispuestos a aplicar fungicidas.

Algunos productores comienzan la cosecha tan temprano como a los

7-8 meses, continuando por un período de hasta cuatro meses al recolectar pequeñas fracciones de su cultivo 1 ó 2 veces a la semana. El rendimiento medio bajo estas circunstancias tan variables generó un valor de 13.5 ton/ha cuando la yuca fue plantada en monocultivo, pero oscilando entre un máximo de 31.0 ton y un mínimo de 5.0 ton/ha. Cuando la yuca fue sembrada junto al ñame su rendimiento medio baja significativamente a 7.4 tons, pero junto al maíz se acerca a las 11.0 tons/ha. Más de tres cuartas partes de los productores encuestados de Herrera cosechan bajo su directa responsabilidad, con 13% delegando dicha actividad al comprador, y un 10% combinando ambos procedimientos.

Casi la totalidad de la yuca producida en la región es comercializada a los mercados urbanos, con el 4% restante destinada a la alimentación animal, y/o al consumo familiar dentro del predio. En solamente un caso encuestado, el 100% de la producción de yuca estaba destinada a la alimentación de cerdos. Treinta y nueve por ciento de los productores recibieron el pago de la cosecha al momento de la entrega del producto al comprador, 30% tomaron contacto con el efectivo solo después que el comprador concretara la venta del bien, y el 31% remanente fueron otras diferentes combinaciones de ventas y arreglos de pago entre las partes intervinientes.

Cuando la venta se efectúa fuera de la finca, específicamente en el mercado de Panamá, el transporte es responsabilidad del productor realizándose en vehículos pequeños con capacidad entre 1-2 tons a un costo extremadamente elevado de US\$50-60/ton métrica de producto fresco. Lógicamente que el mercado de yuca fresca tiene requisitos superiores en relación al de un mercado para uso animal en cuanto a calidad y tamaño de las raíces ofrecidas, por lo que se impone una selección del producto cosechado previo a su venta. Como consecuencia de ello, entre un 10-17% de la cosecha es descartada para tales fines, dedicándose este subproducto en algo más de la mitad de los predios visitados a un uso animal en la misma explotación, o a su comercialización como tal hacia empresas porcícolas de la zona, a un precio de descuento. Sin embargo, llama la atención que un 45% de las explotaciones no reportan ningún uso específico a este descarte, por lo que se debe interpretar que se

desaprovecha en su totalidad.

La mano de obra promedio involucrada para la producción de yuca fue estimada en esta encuesta en 47 jornales totales/ha (30% familiar y 70% contratada), cifra ésta 23% inferior a la que verifica México en su yuca comercial, a pesar de que el grado de mecanización del cultivo es muy similar en ambos casos (incluso en México la cosecha es semi-mecanizada, en contraposición con Panamá en donde es totalmente manual). Esto nos podría indicar algún grado de subestimación de este parámetro. Por su parte el asocio yuca-ñame casi implica duplicar los requerimientos de mano de obra por hectárea en relación al monocultivo (93 jornales totales/ha), en contraposición con el sistema yuca-maíz que solo exige un ligero incremento de este factor de producción (52 jornales/ha).

Finalmente la encuesta verifica lo que de antemano se anticipara sobre las preocupaciones que el productor de yuca de la región exhibe respecto a la inseguridad de la capacidad de absorción del mercado de yuca fresca en el país, lo que automáticamente se traduce en fuertes fluctuaciones de los precios recibidos por el agricultor, así como la falta de apoyos crediticios para financiar los importantes costos operativos que el cultivo involucra. Consecuentemente estas fuertes restricciones están poniendo un freno severo a la expansión del cultivo bajo esta forma, a menos que dichas limitantes puedan ser superadas mediante: (a) la incorporación de las técnicas post-cosecha de conservación del producto fresco que tanto éxito están teniendo a nivel piloto en países como Colombia y Ecuador (ej., tratamiento con fungicida y embasado en bolsas de polietileno), (b) asociado con el punto anterior, eficientar los procedimientos de transportación del producto fresco hacia los mercados urbanos, como forma de abaratar aún más el precio final de este carbohidrato, (c) desarrollar la infraestructura adecuada para posibilitar el secamiento natural del producto fresco previo a su utilización como alimento animal, y (d) brindar apoyos crediticios al productor yuquero en las mismas condiciones que cualquier otro producto tradicional, al irse derribando las restricciones de mercado con la implementación de las mejoras antes citadas.

En consecuencia, si bien esta muestra representativa de productores de yuca comercial de Herrera difiere en sus características generales con la media de este cultivo en el país, en términos de escala de producción, utilización de insumos modernos, rendimientos unitarios, y destino del producto obtenido, esencialmente los mismos factores limitantes a la producción citados en el párrafo anterior están afectando a unos y otros, frenando con ello las oportunidades de una posible mayor contribución de la yuca al desarrollo agropecuario de Panamá.

2) Costos-Beneficios-Rentabilidad Privada de la Producción y Procesamiento del Cultivo de Yuca, en Relación al Maíz y el Sorgo.

En esta sección se procederá a reportar los resultados económicos privados de la actividad yuca, tanto a nivel de producción como de su procesamiento en yuca deshidratada, con miras de explorar el potencial para su eventual utilización como materia prima en la preparación de dietas animales. A fines comparativos se elaboraron simultáneamente presupuestos equivalentes para maíz y sorgo, dado que estos cereales son frecuentemente utilizados por la industria de alimentos balanceados animales de Panamá, compitiendo directamente tanto en las proporciones en que estos ingredientes pueden ser mezclados entre sí para obtener una dieta balanceada equilibrada, así como también por los recursos de tierra, trabajo y capital que dichos cultivos exigen para llevar a cabo tales producciones (Apéndices 4.1, 4.2, 4.3).

En todos los casos se seleccionaron tecnologías mejoradas de producción, con lo que los rendimientos esperados son de 3,129 kgs/ha para el maíz, 3,363 kgs/ha para el sorgo, y 15 tons/ha para la yuca ^{1/}. Implícitamente entonces, se supone que es igualmente fácil (difícil) y seguro (riesgoso) alcanzar dichas metas de productividad en la medida

^{1/} La mayor parte de los coeficientes técnicos utilizados fueron suministrados a este autor en comunicaciones personales por parte de técnicos del MIDA de Panamá. Los mismos corresponden a promedios ponderados provenientes de las provincias de Herrera, Los Santos, y Chiriquí en donde estos tres cultivos tienen alta incidencia, compitiendo entre sí por recursos escasos.

que el productor adopte un paquete tecnológico como el que se supone en los respectivos presupuestos. Los precios recibidos que puede esperar un agricultor fueron supuestos en US\$230/ton, US\$206.35/ton, y US\$45.7/-ton para maíz, sorgo, y yuca respectivamente (los mismos eran los vigentes a julio de 1986). Con ello, los ingresos brutos totales son máximos para el maíz, seguido del sorgo (3.6% menos) y yuca (4.7% menos).

Por el lado de los costos las diferencias resultan más acentuadas, tanto en sus montos totales como en su composición. Globalmente, de acuerdo a los supuestos contemplados, es el maíz en donde se incurre en más gastos, con US\$710.79/ha, seguido por el sorgo (8.3% menos), y yuca (15.6% menos). El componente de mano de obra es el rubro que más difiere entre ellos, representando en la yuca casi un 42% de los costos totales (50 jornales/ha), en contraposición con apenas un 3.6% en el sorgo (4.75 jornales/ha), y 11.9% del maíz (13.7 jornales/ha).

Los costos en maquinaria son máximos en sorgo al incurrir en 7 horas de tractor/ha y 1 hora de cosechadora/ha (33.5% de los gastos), seguido por el maíz que exige 7.5 horas de tractor (24.2% de los gastos), y 6 horas de tractor para la yuca (17.9% de los gastos). Un tercer rubro significativo son los insumos propiamente dichos (ej., fertilizantes, semillas, herbicidas, plaguicidas, bolsas, hilo y seguro agrícola). En este caso es el maíz el que lleva la delantera con 35.7% de los costos totales, al necesitar fundamentalmente una mayor concentración de fertilizantes, seguido de cerca por el sorgo (32.1%), y finalmente la yuca (13.1%). Es necesario aclarar que a este último no se le imputa cargo alguno por seguro agrícola, a diferencia de los cereales, por no existir tal mecanismo de garantía en caso de fracaso de la cosecha.

Los cuatro rubros restantes explican colectivamente casi un 30% de los costos totales en todos los casos. Ellos son las erogaciones por: (a) transporte de insumos al predio y transporte de la cosecha de cereales a la ciudad de Panamá (en el caso de la yuca se supone primeramente que la raíz fresca es movilizad a patios de secado relativamente

cercanos a los predios de los productores, para luego considerar el costo de transportar el producto ya seco a Panamá, pero cargándoselo a los costos de la etapa del procesamiento de yuca), (b) renta de la tierra, (c) intereses (o costo de oportunidad) sobre capital circulante requerido para conducir la producción, y (d) imprevistos.

La partida por renta de tierra se estipuló en US\$70/ha en todos los casos, lo cual genera al propietario de la misma un 14% de interés anual sobre el valor de adquisición de la tierra (US\$500/ha en las zonas agrícolas consideradas). No cabe duda que dicho interés se puede considerar como altamente competitivo en los mercados de capitales. Sin embargo, algo más problemático es el hecho de que mientras los cereales requieren en promedio desde la preparación del cultivo hasta su cosecha de unos 6 meses de duración, el cultivo de yuca sí consume el año completo para su obtención, a pesar de lo cual se imputa una misma renta. Consultando sobre estos tópicos fue argumentado a este autor que en la mayor parte de la superficie agrícola en donde se llevan a cabo estos cereales no hay suficiente agua como para intentar un segundo ciclo de cultivos (especialmente en Herrera y Los Santos), por lo que la tierra queda ociosa de cualquier manera, con lo que el hecho de que la yuca continúe avanzando en su desarrollo no por ello compite con productos alternativos.

En donde sí se ponderó diferencialmente entre los cereales y la yuca fue en el costo de oportunidad del capital circulante. Así, mientras para los primeros se imputó un interés del 9% sobre 75% de los costos variables durante 6 meses, a la yuca se le cargó el mismo interés sobre 66% de los costos variables, pero durante un año. Finalmente los imprevistos fueron calculados sobre la base de un 5% de los costos totales en los tres casos.

Consecuentemente, los beneficios netos privados a nivel del productor fueron estimados en US\$8.89, US\$41.86 y US\$85.45/ha para el maíz, sorgo y yuca respectivamente. Al estar incluido en los costos totales la partida por concepto de renta de tierra, estos beneficios debieran ser imputados a efectos de remunerar a la administración, único factor

de producción no contemplado en los egresos. O, visto de otra manera, si ignoramos al concepto renta de tierra de los costos de producción, los beneficios netos esperados generarían una rentabilidad privada del 15.8%, 22.4%, y 31.1% para maíz, sorgo y yuca respectivamente, sobre una base de un valor de tierra de US\$500/ha. De ahí que se pueda concluir que la rentabilidad privada para estos tres cultivos es atractiva en el entendido de que la tecnología empleada sea intensiva en insumos, y los rendimientos esperados sean consiguientemente elevados (ej., maíz: 3,090 kgs/ha, sorgo: 3,160 kgs/ha, y yuca: 13,130 kgs/ha, para cubrir los costos totales, incluida la renta de la tierra).

Para hacer más válida la comparación entre estos tres rubros se necesitará incluir los costos del secamiento de yuca a los costos de producción de esta raíz, como forma de arribar a un producto final que sea utilizable por la industria del concentrado de Panamá. Todos los supuestos y desglose de costos fijos y variables relativos al procesamiento de yuca fresca en patios de concretos se presentan en el Apéndice 4.4. Esencialmente se observa la elevada proporción de costos variables en el total de erogaciones, con las partidas de materia prima y mano de obra representando casi 75% del total. El costo de la materia prima a ser secada lógicamente coincide con el precio recibido por el productor de yuca fresca. Asimismo, dentro de los costos fijos calculados se incluye también la partida por costos de oportunidad de las inversiones (ej., 10% anual) por concepto de patios de concreto, bodega, y la maquinaria requerida para este proceso (ej., picadora con su motor, báscula, implementos menores, etc.). El resultado final nos indica que la yuca deshidratada ya ubicada en Panamá costaría a razón de US\$170.14/ton, valor este que resulta muy competitivo toda vez que la adquisición de sorgo y maíz implica a un industrial del concentrado no menos de US\$206.35/ton y US\$230/ton, respectivamente (ver Saez b/).

3) Medidas de Incentivos a la Producción Nacional de Maíz, Sorgo y Yuca en Panamá.

Dos indicadores seleccionados para evaluar el grado de incentivo o protección a los cultivos bajo estudio son el "coeficiente nominal y el

efectivo de protección". Comenzando por el nominal, lo único que se necesita para su cálculo son los precios internos y los cif de los productos, así como el costo del transporte interno desde las zonas de producción al centro de consumo ^{2/}. Los precios internos de los cereales y de yuca deshidratada ya fueron indicados en la sección previa, al igual que el costo del transporte. Lo único que nos resta son los precios internacionales a nivel de frontera. Para ello se consultó a los precios promedios de enero-julio de 1986 reportados por el Banco Mundial. En el caso del maíz y sorgo se contaba con los precios fob en los puertos del Golfo de USA, a los que se le añadió un 15% por concepto de fletes, seguros, carga y descarga, etc. En lo que tiene que ver con el precio de yuca seca se consultó dos fuentes: (i) US\$92/ton cif Rotterdam como promedio de 1985, según FAO; (ii) una combinación de precios de sorgo y pasta de soya durante 1986 en donde aproximadamente se consigue un nutriente con valor comparable al de un cereal ^{3/}. Usando este último criterio con la fuente del Banco Mundial antes citada, se arribó a un precio muy similar al anterior: US\$91.34/ton. En definitiva se usó este último como valor cif representativo de yuca deshidratada puesta en Panamá.

A continuación se pasa a calcular los correspondientes coeficientes CNP:

$$CNP_i = \frac{p_i^d}{\frac{cif}{p_i + T_p - T_i}} \quad (1)$$

donde,

p_i^d = Precio Interno del producto en cuestión,

p_i^{cif} = Precio cif del producto i, convertido a la tasa de cambio oficial,

^{2/} Se recuerda al lector que Panamá tiene como moneda circulante el "Balboa" cuya unidad equivale exactamente a US\$1.00. Consecuentemente no es necesario la conversión a ningún tipo de tasa de cambio para ajustar los precios cif internacionales expresados en dólares americanos, a su equivalente en moneda nacional.

^{3/} Dicha fórmula para arribar a un precio "equivalente" de yuca seca es: 1.2 (precio del sorgo granífero) - 0.2 (precio de la pasta de soya).

T_p = Costo de transporte interno desde el puerto de entrada al lugar de consumo final,

T_i = Costo del transporte interno desde los centros nacionales de producción al centro de consumo final.

Con la ecuación (1) estamos haciendo la comparación entre ambos precios a nivel del mercado del consumidor final del producto i , al ponernos en la posición de un industrial panameño que tendría la opción de comprar el producto internamente o adquirirlo desde el exterior. Asimismo, para el caso de Panamá la variable T_p se consideró nula, ya que es en la propia ciudad (puerto) capital en donde se encuentra su mayor utilización de los productos bajo consideración.

$$CNP_{Maíz} = \frac{230.00}{(115.92 - 22.00)} = 2.45$$

$$CNP_{Sorgo} = \frac{206.35}{(107.07 - 22.00)} = 2.43$$

$$CNP_{Yuca} = \frac{170.14}{(91.34 - 22.00)} = 2.45$$

Curiosamente los tres coeficientes nominales de protección son iguales o muy similares entre sí. Ellos nos están indicando de la existencia de una muy elevada tasa de protección que el Gobierno de Panamá está ejerciendo para beneficios de sus productores, pero en perjuicio de su población consumidora. Por otra parte, de no existir este grado de protección las rentabilidades privadas de los cultivos en cuestión no solamente caerían sino que se transformarían en claramente negativas. Así, para cubrir los costos internos totales de producción usando precios de frontera se requeriría de una duplicación de los rendimientos unitarios, los cuales ya de por sí eran bastantes elevados.

Sin embargo, una mejor medida de protección es en realidad el coeficiente efectivo de protección (CEP) que el CNP, al estar considerando simultáneamente el mercado de productos y a una parte del mercado de insumos (o sea aquellos que sí tienen contacto con los mercados internacionales). Para su cómputo solo se necesitará expandir en los precios de estos insumos evaluados a sus niveles cif, pues los respectivos precios de los insumos internos y sus correspondientes cantidades físicas ya habían sido tomados en cuenta en el cálculo de las rentabilidades privadas.

$$CEP_i = \frac{p_i^d - \left(\sum_{j=1}^n a_{ij} r_j^d \right) / Y_i}{p_i^{cif} - \left(\sum_{j=1}^n a_{ij} r_j^{cif} \right) / Y_i} \quad (2)$$

donde,

r_j^d = precio interno de insumos que se movilizan en los mercados internacionales,

r_j^{cif} = precio cif de insumos que se movilizan en los mercados internacionales, valorados a precio de frontera y convertido a la tasa de cambio oficial,

a_{ij} = cantidad de insumo empleado,

Y = rendimiento esperado del producto i , por unidad de superficie,

p_i^d, p_i^{cif} : igual que en (1).

Las siguientes son las categorías de insumos considerados para estos efectos: (a) agroquímicos y semillas; (b) gastos en maquinaria: depreciación, diesel, y 75% de reparaciones y mantenimiento; (c) transporte interno (20% del costo total), y (d) imprevistos, asignándole según la proporción que representa el subtotal de insumos con contacto internacional, para cada cultivo. Un detalle de los precios unitarios "sombras" de los insumos se encuentra en los Apéndices 4.5, 4.6, y 4.7 para maíz, sorgo, y yuca respectivamente, sección ésta en donde se

arriba el cálculo de la rentabilidad social de tales rubros.

Considerando los varios insumos involucrados para llevar a cabo los cultivos bajo consideración, y de que no siempre es fácil encontrar su correspondiente precio de frontera, se hizo el esfuerzo por evaluar al menos los más importantes de ellos, extrapolando para aquellos otros conceptualmente similares en donde carecíamos de la información respectiva. Así por ejemplo, para calcular el costo horario operativo de un tractor de 80 HP con su implemento (arado) se partió del valor de adquisición en los EEUU, agregándosele un 20% para contemplar su transporte a Panamá. Con ello se arribó a un precio de US\$37,800, inversión ésta que está lógicamente sujeta a costos por depreciación (vida útil: 10,400 horas), a un costo de oportunidad de este capital (7% anual), gastos por diesel, y reparaciones-mantenimiento (90% del valor del tractor). Juntando todos estos componentes se llegó a un costo horario de US\$10.98 el cual representa un 54.5% del costo interno correspondiente. Este porcentaje se aplicó igualmente a los demás tipos de tractores e implementos. Haciendo lo propio para la cosechadora de cereales se estimó en US\$90,000 su colocación en Panamá, para luego de calcular las cuatro partidas de costos variables y fijos, concluir en un costo horario de US\$41.81, 28.65% inferior al vigente en el país.

Otros insumos evaluados fueron la urea cuyo precio cif Panamá equivaldría a un 40% del precio interno, fertilizantes compuestos cuyo precio de frontera es un 51.5% del precio interno, el herbicida Gesaprim, un 67.6% del interno, semillas mejoradas un 75% del precio interno, etc. En el caso de los costos del transporte interno se simplificó su cálculo asumiendo que su ponderación respecto a los precios internos resulta ser un simple promedio aritmético entre los costos relativos de la operación de un tractor y de una cosechadora automotriz, con lo que se arribó a un porcentaje del 63%.

En el Cuadro inmediato siguiente se resumen los montos totales de aquellos insumos con contacto internacional, evaluados ellos a sus precios internos y de frontera, con miras a arribar en última instancia el cómputo del CEP:

Insumos	Maíz		Sorgo		Yuca	
	Precios Internos	Precios cif	Precios Internos	Precios cif	Precios Internos	Precios cif
	----- US \$ -----					
a) Fertilizantes, semillas, plaguicidas.....	211.83	117.72	160.05	95.21	63.60	40.80
b) Transporte interno, fracción correspondiente al comercio internacional (20%).....	15.01	9.45	15.79	9.94	6.65	4.17
c) Maquinaria: depreciación, diesel, y 75% de reparaciones-mantenimiento.....	117.91	64.21	175.76	104.32	83.23	45.34
d) Imprevistos	16.42	13.89	16.74	9.98	7.31	4.68
T o t a l	361.17	205.27	368.34	219.45	160.79	102.99
Costo/litro seca producida	115.43	65.60	109.53	65.25	26.91	17.23

Consecuentemente, con la información del cuadro anterior es fácil ahora arribar a las medidas del CEP, las que a continuación se presentan siguiendo la ecuación definida en (2):

$$CEP_{Maíz} = \frac{230.00 - 115.43}{115.92 - 65.60} = 2.28$$

$$CEP_{Sorgo} = \frac{206.35 - 109.53}{107.07 - 65.25} = 2.32$$

$$CEP_{Yuca} = \frac{170.35 - 26.91}{91.34 - 17.23} = 1.93$$

Nuevamente se ratifica el alto grado de protección a la producción de estos tres cultivos en Panamá, a pesar de incluir también en el análisis al mercado de insumos. Al igual que los niveles de precios de los productos, el precio de los insumos se encuentran sustancialmente por encima de los precios de frontera, con lo que los valores agregados medios entre ambos tipos de precios no son sustancialmente diferentes de lo anteriormente observado con los CNP. Con todo, una leve disminución

se verifica para el caso de los cereales, y algo más pronunciada resulta en el de yuca.

Sin embargo, la medida de CEP para la yuca anteriormente estimada no es enteramente comparable con la de los cereales, ya que para el caso de la raíz están faltando todos los insumos requeridos para su transformación en seca, así como su transporte al centro de consumo final. Para tales efectos se construyó el Cuadro 1 en donde se resumen los costos privados del proceso de secamiento de yuca que ya fueron reportados en el Apéndice 4.4, al tiempo que se agrega la información de los correspondientes costos sociales para cada componente. Concentrándonos inicialmente en aquellos insumos con contacto internacional se arribó a que los rubros de inversiones en patios y equipos costaría a precios de frontera un 23% menos que a precios internos, por lo que las partidas por depreciación reflejan este descuento. Un componente más importante aún es el costo de la materia prima, la cual debe guardar proporción con el costo del producto final. Dejando margen suficiente para todos los demás componentes de costos de procesamiento se arribó al máximo precio que puede recibir un productor de yuca fresca consistente con el precio final de frontera del producto seco, concluyéndose que se necesita de un descuento del 51.1% en relación a los precios internos. Finalmente, para las partidas por reparación y mantenimiento de equipos, combustibles y lubricantes, y transporte se siguieron los mismos criterios que los previamente enunciados en la sección de costos de producción. Agrupando entonces los componentes de insumos con contacto internacional a precios internos y de frontera, se llega a una estimación del CEP de yuca más preciso que el previamente calculado:

Insumos	Yuca Seca	
	Costos Privados	Costos Sociales
	----- US\$/ton seca -----	
a) Depreciación de equipos e inversiones fijas	8.90	6.85
b) Materia Prima	114.71	56.05
c) Rep. y Mantenimiento	1.47	0.89
d) Comb. y Lubricantes	1.68	0.61
e) Transporte	4.40	2.77
<u>Total</u>	<u>131.16</u>	<u>67.17</u>

Cuadro 1: Comparación de Costos Privados y Sociales en el Secamiento Natural de Yuca Realizado en Patios de Concreto de 500 m², Herrera, Panama, julio, 1986.

	<u>Costos Privados</u>	<u>Costos Sociales</u>
Depreciación de Equipos e Inversiones Fijas	US\$ 8.90	US\$ 6.85
Costos de Oportunidades de las Inversiones	<u>US\$ 7.55</u>	<u>US\$ 3.69</u>
Sub-Total:	US\$ 16.45	US\$ 10.54
Materia Prima	US\$114.71	US\$ 56.05
Reparación y Mantenimiento Picadora ..	US\$ 1.96	US\$ 1.18
Combustibles y Lubricantes	US\$ 1.68	US\$ 0.61
Mano de Obra	US\$ 12.55	US\$ 8.79
Intereses Bancarios	US\$ 0.79	US\$ 0.31
Transporte	<u>US\$ 22.00</u>	<u>US\$ 13.86</u>
Sub-Total:	US\$153.69	US\$ 80.80
T o t a l:	<u>US\$170.14</u>	<u>US\$ 91.34</u>

$$CEP_{Yuca (2)} = \frac{170.14 - 131.16}{91.34 - 67.17} = 1.61$$

Con esta nueva estimación se concluye de que si bien la producción de yuca deshidratada continua evidenciando elevado proteccionismo efectivo por parte de la política agrícola panameña, su grado de aislamiento frente a los mercados internacionales es de un 30% menos que los correspondientes para maíz y sorgo.

4) Medidas de Rentabilidad Social y de Ventajas Comparativas.

Este es el paso final del presente análisis en donde se estimará la rentabilidad social de los tres cultivos, esto es, aquella que se generaría dentro de una economía libre de distorsiones en ambos mercados de productos e insumos, así como una evaluación del indicador último de ventajas comparativas que tiene el país, dados los niveles tecnológicos presentes y las relaciones de precios internacionales vigentes. Para arribar a estos objetivos se deberán ahora incluir los componentes no contemplados hasta este momento, como son aquellos insumos que no tienen vinculación con los mercados internacionales. Ellos son de acuerdo con este trabajo: (a) Insumos: sacos, hilo, y seguro agrícola; (b) Maquinaria: costo horario de desgranadoras y fumigadoras, en adición al costo de oportunidad del capital de todos los componentes de maquinaria, y de un 25% de los costos de reparaciones-mantenimiento por considerarse que se trata de trabajo; (c) Transporte interno de insumos y productos: 80% del costo total; (d) Mano de Obra para todas las actividades; (e) Costo de Oportunidad del capital circulante que financia los costos variables de operación, (f) Renta de la Tierra; (g) porción de las partidas de imprevistos supuestamente sin contacto internacional.

De los insumos mencionados en el párrafo anterior, los que justifican unas líneas aclaratorias adicionales son los de mano de obra, renta de la tierra, y costo de oportunidad del capital circulante, ya que todos los demás se obtienen por diferencia al descontar los correspondientes insumos valorados a precios frontera con contacto internacional.

Comenzando por la tasa de interés "sombra" del costo de oportunidad del capital empleado, simplemente se la redujo de un 9% a un 7% anual, por considerar a esta última como más representativa al momento frente a las bajas tasas de inflación mundial experimentadas por las economías industriales más desarrolladas.

En lo que tiene que ver con la mano de obra rural su real costo de oportunidad es un tanto más complejo para su estimación. Idealmente hubiera correspondido evaluar la productividad física marginal de dicho factor en la alternativa más rentable de utilización, para luego valorar el producto generado de la misma mediante su correspondiente precio sombra. Lamentablemente no se contaba con esta información. Por otro lado, aparece claro el hecho de que si los tres cultivos bajo consideración son representativos de la producción agropecuaria panameña, y los mismos evidencian muy elevadas tasas de protección efectivas, el valor marginal del trabajador rural también estará sobrevalorado proporcionalmente. Si bien no cabe dudas de que el precio sombra del trabajo deberá ser inferior al de su precio interno, el problema continúa siendo su cuantificación. Consecuentemente se procedió a estimar la media ponderada de los CEP de los tres cultivos, siendo el factor de ponderación el valor bruto total de los mismos, arribándose a un coeficiente de 2.24. De ser correcto el extrapolar para toda la agricultura de Panamá, este último coeficiente implícitamente nos estaría indicando que el salario mínimo rural debiera valer un 44.6% de su precio interno, si fuera válido asumir una directa proporcionalidad entre ambos tipos de variables. Sin embargo este último supuesto resulta ser un tanto dudosa su validez puesto que una drástica caída en el salario real de la población rural fruto de disminuciones de los precios de los productos internos, generaría muy significativos desplazamientos de recursos humanos hacia otros sectores de la economía, por lo que de una condición de excedente se pasaría a condiciones de escasez del factor trabajo, lo cual tendería a subir su precio relativo. Tentativamente, por lo tanto, se asignó un valor del 70% al salario sobre su respectivo nivel interno.

Por último, el concepto valor social de la renta de la tierra debe computarse como un valor residual, luego de ser pagos todos los demás

factores de la producción. Al proceder a calcular los costos sociales totales para todos los cultivos se encontró que ninguno de ellos generaba márgenes positivos, dados los niveles presentes de precios internacionales de productos. Consecuentemente, se asignó un valor nulo a este concepto.

Un resumen de la evaluación social se encuentra en el Cuadro 2 en donde también para fines comparativos se reporta la evaluación privada de los tres cultivos. Como ya se adelantara, se encontró que ninguno de los casos evidencian saldos favorables, siendo menores las pérdidas en el caso del sorgo, seguida por yuca, y finalmente el maíz. A efectos de cubrir los costos sociales totales se hace necesario aumentos de rendimientos (o los precios internacionales) en un 2.6% para el sorgo, 5.2% en yuca, y 10.5% en maíz, en relación a los supuestos iniciales de productividad por hectárea sostenidos en este trabajo. La razón última de esta situación desfavorable es lógicamente, la caída más que proporcional de los ingresos evaluados a precios de frontera frente a sus respectivos precios de productos internos, en relación a la disminución experimentada en los costos sociales de producción. Este hecho es particularmente notorio en yuca cuyos ingresos son los que más abruptamente caen, mientras que sus costos son los menos sensibles a la baja.

Otra forma de ver este panorama de evaluación social de producción es mediante la ecuación (3) la cual define una medida de ventajas comparativas:

$$DRC = \frac{\sum_{j=k}^n a_{ij} r_j}{\frac{cif}{P_i} - \frac{\sum_{j=1}^{k-1} a_{ij} r_j}{cif}} \quad (3)$$

donde,

$j = 1, \dots, k-1$, corresponde a los varios insumos que se movilizan en los mercados internacionales,

$j = k, \dots, n$, corresponde a los varios insumos que no se movilizan en los mercados internacionales,

Cuadro 2: Rentabilidad Privada y Social de los Cultivos Maíz, Sorgo y Yuca en Panamá, a Precios de julio 1986, en US\$/ha.

<u>Concepto</u>	M A I Z		S O R G O		Y U C A	
	<u>Privada</u>	<u>Social</u>	<u>Privada</u>	<u>Social</u>	<u>Privada</u>	<u>Social</u>
<u>Costos Totales</u>	710.79	400.93	652.11	369.32	600.05	352.43
(a) Insumos	253.52	159.41	209.53	144.69	78.60	63.80
(b) Maquinaria	171.80	105.99	218.53	131.68	107.60	61.16
(c) Transporte	75.03	47.27	78.94	49.72	33.24	20.87
(d) Mano de Obra	84.49	59.40	23.78	16.64	250.00	175.00
(e) Renta Tierra	70.00	0.00	70.00	0.00	70.00	0.00
(f) Intereses Bancarios	22.10	9.77	20.28	9.00	32.04	14.82
(g) Imprevistos	33.85	19.09	31.05	17.59	28.57	16.78
INGRESOS BRUTOS	719.68	362.71	693.96	360.08	685.50	334.95
BENEFICIOS NETOS	8.89	-38.22	41.86	- 9.24	85.45	- 17.48
<u>Rendimiento para Cubrir</u>						
<u>Costos Totales, kg/ha</u>	3,090	3,459	3,160	3,449	13,130	15,783

r_j^s = costo de insumos sin contactos internacionales valorados a sus respectivos precios sombras,

r_j^{cif} = costo de insumos participantes en los mercados internacionales valorados a sus respectivos precios cif,

p_i^{cif} = en este caso nos indica el valor de la producción obtenida (precio por cantidad) valorada a precios cif.

Este indicador, a diferencia del CNP y el CEP, toma en cuenta solamente precios de frontera para los bienes intercambiables internacionalmente, y los costos de oportunidad de los recursos internos no intercambiables, pero valorados a precios internacionales. El Cuadro 3 nos ayuda a conducir este desglose de insumos para todos los casos en estudio.

En definitiva se confirma que todos los DRC son mayores a 1, lo cual nos está indicando nuevamente la rentabilidad social negativa encontrada previamente. Sin embargo, la magnitud de estas pérdidas son relativamente pequeñas para sorgo y yuca (DRC = 1.07 y 1.08, respectivamente), y más importantes para el maíz (DRC = 1.24).

El DRC estimado de yuca de 1.08 representa solamente los beneficios/costos de generar esta raíz en su faz directamente productiva, esto es, hasta el momento previo a su proceso de secamiento. Cuando se aísla el proceso de secamiento en sí y se evalúa el mismo siguiendo la metodología "DRC", se arriba a un coeficiente de 1, por la sencilla razón de que el precio social de la materia prima asignado (y consecuentemente el precio social del producto fresco) había sido fijado en la proporción justa para ser consistente con el precio de frontera de la yuca deshidratada. Consecuentemente, el problema sigue existiendo a nivel de su producción en donde, de ser correctos todos los supuestos y planteamientos considerados, los recursos internos aplicados en yuca (ej., mano de obra, capital, tierra, y demás componentes no intercambiables de los otros insumos) resultan mayores al valor agregado de su producción que sirve para remunerar los anteriores recursos.

Cuadro 3: Cálculo Tendiente a la Estimación del Coeficiente "DRC" para los Cultivos Maíz, Sorgo y Yuca en Panamá.

Concepto	----- MAÍZ -----		----- SORGO -----		----- YUCA -----	
	Insumos que Participan en Comercio Internacional	Insumos que no Participan en Comercio Internacional	Insumos que Participan en Comercio Internacional	Insumos que no Participan en Comercio Internacional	Insumos que Participan en Comercio Internacional	Insumos que no Participan en Comercio Internacional
	----- US \$ -----					
Productos Agroquímicos	117.72	19.15	95.21	21.24	48.80	15.00
Transporte	9.45	37.82	9.94	39.78	4.17	16.70
Gastos en Maquinaria	64.21	41.78	104.32	27.36	45.34	15.82
Imprevistos	13.89	5.20	9.98	7.61	4.68	12.10
Seguro Agrícola		22.54		28.24		0.00
Mano de Obra		59.40		16.64		175.00
Renta de Tierra		0.00		0.00		0.00
Intereses		9.77		9.00		14.82
T O T A L	205.27	195.66	219.45	149.87	102.99	249.44
Valor de la Producción a Precios CIF	362.71		360.08		334.95	
Valor Agregado Respecto a Insumos Comercializados Internacionalmente	157.44		140.63		231.96	
D R C	$\frac{195.66}{157.44} = 1.24$		$\frac{149.87}{140.63} = 1.07$		$\frac{249.44}{231.44} = 1.08$	

Conduciendo un sencillo análisis de sensibilidad para el caso de yuca se encuentra que su DRC quedaría en 1 con una caída del valor sombra del salario rural a 62.8% de su costo interno en lugar del 70% asignado, o alternatively, con un incremento del 5.4% en el precio del producto seco.

D) Demanda Potencial de Yuca Deshidratada por parte de la Industria Avícola Tecnificada de Panamá

Comprobada la adecuada rentabilidad privada de la producción-procesamiento de yuca en Panamá, sobre la base de las eficiencias físicas conseguidas en la provincia de Herrera cuando se aplican niveles tecnológicos superiores en relación a la media nacional, y que desde el punto de vista social dicho cultivo al menos no es suficientemente negativo como para desestimular su apoyo, llega el momento de conducir una estimación sobre el potencial de demanda nacional de esta raíz por parte de la industria avícola moderna del país, la cual depende para su crecimiento de un suministro seguro y permanente de alimentos balanceados de alta calidad y a precios competitivos.

A diferencia de México en donde tanto el sector avícola como el porcícola, y en menor medida el lechero, demandan una gran cantidad de alimentos concentrados, en Panamá el sector que claramente predomina en la utilización de raciones balanceadas es el avícola (con un 90% de participación), por lo que el presente análisis se reducirá a evaluar la demanda por parte de los productores de pollos de engorda y de huevo (aves ponedoras). Para tales efectos se elaboraron modelos de mínimo costo tendientes a simular la combinación de alimentos balanceados consistentes con las necesidades nutricionales de estos animales. Específicamente se corrieron seis diferentes modelos matemáticos (tres para pollos de engorda, y tres para aves ponedoras) con miras a caracterizar adecuadamente los requerimientos alimenticios de dichos animales a lo largo de sus vidas productivas. Los coeficientes técnicos utilizados en estos modelos se presentan en el Apéndice 5.1 y 5.2 al reportarse los precios unitarios a nivel de fábrica (a junio de 1986) de los diversos ingredientes combinados en las mezclas, sus respectivas

composiciones químicas, así como también los requerimientos mínimos que exigen los pollos y aves ponedoras en sus diferentes etapas de crecimiento y desarrollo. A efectos de hacer esta simulación lo más cercana posible a la realidad, fueron incluidas 17 restricciones nutricionales simultáneas que la ración de mínimo costo debe satisfacer a efectos de poder conseguir un máximo de producción en las aves a ser alimentadas.

1) Soluciones Optimas de Mínimo Costo

Los promedios ponderados de las soluciones óptimas y sus correspondientes composiciones químicas para las dietas de pollos de engorda (PE) y aves ponedoras (AP) se reportan en el Cuadro 4, haciéndose también la distinción entre raciones en donde la harina de yuca es una opción real, a cuando no lo es ya sea por falta de materia prima y/o de interés en su utilización (por mayor detalle en las soluciones encontradas, favor referirse al Apéndice 5.3 y 5.4).

Comenzando con la situación en que la yuca no es una alternativa a seleccionar se verifica que en ambos tipos de dietas la concentración de cereales es claramente mayoritaria en términos de volúmenes empleados, con un total de 78.3% en pollos de engorda y 83.0% en aves ponedoras. Sin embargo, el desglose de los cereales es muy diferente entre sí, pues mientras en dietas de pollos el maíz resulta ser el preferido con un 58%, en AP el sorgo prevalece con un 53%. Por su parte, el acemite (salvado de trigo) solo es demandado en AP en casi un 26%, y el gluten de maíz es incorporado en cantidades aproximadamente iguales en ambos casos. Lógicamente que dadas las mayores necesidades proteicas de las dietas de PE, éstas demandas hasta casi un 28% de fuentes como la harina de pescado, soya y gluten de maíz, en contraposición de un 20% en AP. Las aportaciones de minerales y aminoácidos esenciales en cantidades adicionales son nulas o mínimas en ambos casos.

Analizando ahora la composición química de estas dietas cuando a la yuca no se le permite competir, se verifica que en todos los casos los niveles de energía metabolizable se encuentran a los mínimos exigidos de casi 321 Mcal/100 kgs de ración en PE y 276 Mcal/100 kgs en AP. Siendo

Cuadro 4: Promedios Ponderados de Soluciones Optimas de Costo Mínimo para Pollos de Engorda y Aves Ponedoras.

Concepto	POLLOS ENGORDA		AVES PONEDORAS	
	Dieta con Yuca	Dieta Sin Yuca	Dieta Con Yuca	Dieta Sin Yuca
Costo (US\$/ton)	269.94	278.43	228.67	232.53
Maíz (%)	34.97	57.88	0.00	0.00
Yuca (%)	20.00	---	30.26	---
Sorgo (%)	12.59	14.19	31.19	52.76
Acemite (%)	0.08	0.00	0.88	25.83
H. Pescado (%)	12.53	11.59	4.66	4.59
Soya (%)	8.63	10.09	16.88	10.94
Gluten Maíz 60 (%)	11.07	6.18	6.10	4.38
Caliza (%)	0.00	0.00	8.42	0.62
Dical (%)	0.00	0.00	1.61	0.85
Lisina (%)	0.14	0.08	0.00	0.00
Metionina (%)	0.00	0.00	0.00	0.04
Composición Química				
Energía (Mcal/100 Kg ración)	320.92	320.92	275.69	275.69
Proteína (%)	22.45	21.30	17.78	19.42
Grasa (%)	3.15	4.03	1.72	3.22
Fibra (%)	n/c	n/c	4.10	4.01

relativamente costoso el aporte de una unidad más de energía en la dieta, los modelos satisfacen solamente los requerimientos mínimos. Lo mismo se puede decir de los niveles en lisina, arginina (a excepción de AP en faz de crecimiento, en donde la treonina es limitante), fósforo total, y calcio en AP y pollo finalizador. La metionina aparece como limitante en aves en faz de postura e iniciación, y en pollos de iniciación y crecimiento. Sin embargo lo más llamativo resultó ser los excedentes de proteína total aportados en las raciones, con un promedio de 1.4 unidades adicionales en PE y 3.4 unidades más en AP. La razón de ello es que seguramente los niveles mínimos a ser satisfechos en los aminoácidos esenciales solo pueden ser cumplidos cuando se aporta una cantidad en exceso de proteína total. Dado que los compuestos lisina y metionina pueden ser adicionados independientemente, posiblemente las exigencias en arginina (treonina) sean las causantes de estos desvíos por encima de lo estrictamente necesario. En definitiva, las dietas para AP resultan en promedio un 16.5% inferiores en costo respecto a las de PE, como directa consecuencia de las menores necesidades energéticas y proteicas de aquellas.

La composición de las raciones balanceadas cambian sustancialmente toda vez que se posibilita al modelo elegir en adición a las materias primas tradicionales, a la harina de yuca. La inclusión de yuca, sin embargo, fue restringida a niveles máximos basados en recomendaciones de los autores Gómez et al, 1982, en donde se señala que para dietas de PE los niveles máximos recomendables de esta raíz no deben superar el rango de 20-30% (por razones de seguridad se utilizó el nivel inferior), y en AP el rango entre 40-60% (se utilizó 50% como valor máximo). Estas concentraciones máximas de harina de yuca fueron importantes en establecer las soluciones óptimas en pollos de engorda dado que en todas sus facetas se seleccionó a la yuca en la proporción del 20%, con lo que de haberse dejado libre su uso, ésta pudo haber sido superior. En dietas de AP solamente en su faz de crecimiento se arriba a concentraciones del 43.5%, ya que en su faz de postura e iniciación las proporciones son inferiores al 30%.

Como cabía esperar dada la composición química de la yuca, su

inclusión eficiente en la dieta posibilita excluir una cantidad igual o aún mayor de cereales, aunque al mismo tiempo es necesario un aumento proporcional en la participación de las fuentes proteicas que compensen el bajo contenido de proteínas y aminoácidos de aquella. Así, mientras el promedio de las dietas de PE resulta rentable el aporte de un 20% de harina de yuca, con lo que se desplaza casi una idéntica cantidad de cereales (particularmente maíz), en AP la incorporación promedio de un 30.3% de yuca hace reducir más que proporcionalmente a los cereales sorgo y acemite. Los consiguientes aumentos en fuentes proteicas sobre la base de las "dietas sin yuca" son de un 4% en PE y de 7.6% en AP. En ambos casos son demandadas mayores cantidades de gluten de maíz, más pasta de soya en AP (pero menos en PE), y leves incrementos en harina de pescado. Finalmente, para AP los incrementos significativos en la utilización de caliza y parcial de dical explican la caída más que proporcional de los cereales antes mencionados.

En términos de la composición química de la ración obtenida cabe esperar que los niveles de energía metabolizable sean idénticos respecto a las dietas sin inclusión de yuca, esto es, a las cantidades mínimas estrictamente necesarias; sin embargo, ahora se verifican menores niveles de grasa dado el bajo contenido en lípidos de la harina de yuca (la diferencia es de 0.88% y 1.5% menores en PE y AP, respectivamente). En caso de que se entendiera poco recomendable estos menores contenidos de grasa, se debería corregir a dichas dietas con el agregado de algún producto apropiado (ej., sebo).

Nuevamente se constatan niveles en exceso de los mínimos impuestos en proteína total (la única excepción se encuentra en AP iniciación). En promedio dicho excedente es del orden del 1.71% para AP (en contraposición de un 3.4% cuando no se incluye yuca), y de 2.56% en PE (a diferencia de un 1.4% cuando no se incluye yuca). La lisina se manifiesta como altamente restrictiva en todas las dietas, al igual que la metionina en 3 de los 6 casos, y arginina solamente en AP iniciación. La distinción aparece ahora con el triptófano ya que en todos los casos los niveles satisfechos coinciden con los mínimos requeridos. Por esta razón se sospechó que este compuesto fuera el causante de aquellos

excedentes. Al correrse los modelos sin la inclusión de la restricción triptófano, la proteína total sobrante se reducía significativamente a un 0.28% en AP y 0.62% en PE. Finalmente, la cantidad de fósforo total a ser aportada también es limitante en las 6 dietas analizadas.

Fruto de las diversas combinaciones antes mencionadas, la reducción en el costo unitario de las raciones toda vez que interviene la yuca es de 3.1% en PE y de 1.7% en AP, valores éstos que si bien pueden ser considerados de escasa cuantía, no lo son cuando se extrapola estos ahorros para toda la industria de concentrados nacional (más adelante se extenderá sobre este punto).

2) Análisis de Sensibilidad en las Dietas con Incorporación de Yuca.

En todo modelo de programación lineal y/o cualquiera de sus variantes, es siempre conveniente conducir un análisis sobre la estabilidad de las soluciones encontradas. Ello se debe a que si bien una actividad (ej., ingrediente) puede entrar en una solución óptima, pudiera ocurrir que con un pequeño cambio en su precio relativo la conveniencia de este producto se anulara, con lo que se podría concluir que la solución es claramente inestable. En el contexto del presente estudio esta extensión del análisis se impone sobremanera, dado que se trabajó sobre la base de precios de mercado en un momento particular en el tiempo, en oposición a haberse considerado precios relativos fruto de tendencias de largo plazo. En especial interesa verificar qué tan estable es el producto harina de yuca en las soluciones óptimas toda vez que su precio se ve incrementado en relación al precio de sus más cercanos competidores, maíz y sorgo (ver Cuadro 5).

Así, es posible verificar que para el producto harina de yuca la estabilidad de sus soluciones es sustancialmente más fuerte en PE que en AP, por la razón de que en las primeras su concentración se ubicaba en el máximo admitido predeterminado, mientras que en AP se la dejaba libre. Debido a ello, el precio relativo de la yuca el cual inicialmente era equivalente a un 70.2% y 76.9% de los precios respectivos del

Cuadro 5: Análisis de Sensibilidad en los Precios de los Principales Ingredientes Seleccionados de las Dietas con Yuca, en Donde las Soluciones Básicas no Cambian.

POLLOS DE ENGORDA										
Concepto	Precios Unitarios	Iniciación			Crecimiento			Finalización		
Maíz	US\$251.32/ton	254.5	-	251.1	252.9	-	246.3	254.5	-	251.1
Yuca	US\$176.37/ton	212.7	-	0.0	215.4	-	0.0	212.7	-	0.0
Sorgo	US\$229.28/ton	229.5	-	225.5	236.1	-	227.8	229.5	-	225.5
Acemite	US\$154.32/ton	+ ∞	-	90.4	162.9	-	111.1	+ ∞	-	111.1
H. Pescado	US\$396.83/ton	400.9	-	0.0	408.9	-	0.0	400.9	-	0.0
Soya	US\$310.85/ton	368.1	-	308.8	347.6	-	295.7	347.6	-	308.8
Gluten	US\$337.30/ton	338.3	-	323.4	353.9	-	323.8	338.3	-	323.8

AVES PONEDORAS										
Concepto	Precios Unitarios	Iniciación			Crecimiento			Postura		
Maíz	US\$251.32/ton	+ ∞	-	242.8	+ ∞	-	244.8	+ ∞	-	244.9
Yuca	US\$176.37/ton	183.7	-	174.4	183.7	-	174.3	179.9	-	98.1
Sorgo	US\$229.28/ton	231.7	-	221.3	232.7	-	224.8	235.2	-	226.2
Acemite	US\$154.32/ton	156.5	-	143.1	156.5	-	150.6	+ ∞	-	150.6
H. Pescado	US\$396.83/ton	411.1	-	360.1	+ ∞	-	376.8	404.7	-	376.8
Soya	US\$310.85/ton	358.4	-	304.9	318.8	-	304.6	318.8	-	303.7
Gluten	US\$337.30/ton	371.9	-	323.5	354.5	-	309.3	342.6	-	292.7

maíz y sorgo, podrían subir hasta un 85.0% del maíz o 93.2% del sorgo y aún así su demanda no caería del nivel del 20% de la dieta. En contraposición, un pequeño incremento en el precio relativo de yuca del orden del 2.3% respecto al del maíz y sorgo, implicará que su demanda en AP se vea reducida del nivel del 30.26% previamente encontrado.

Tomando en cuenta que de la utilización de alimentos balanceados con destino a la avicultura de Panamá, un 70% se dirige aproximadamente a la producción de pollos de engorda y un 30% a la producción de huevo, el promedio ponderado para toda la avicultura nacional nos conduciría a una demanda en harina de yuca del orden del 23.1% del total de la ración balanceada, a pesar de que su precio relativo sea incrementado hasta un 81.0% del precio del maíz, o un 88.9% del precio del sorgo. Por el contrario, sustanciales disminuciones en el precio relativo de la harina de yuca respecto a los principales cereales no induciría mayores incrementos en su demanda. Se concluye entonces que si bien la demanda total de yuca es más fuerte en AP que en PE, la estabilidad en las soluciones es sustancialmente más firme en PE que en AP.

3) Estimación de la Demanda Potencial de Yuca con Destino a la Producción de Balanceados, y su Impacto sobre los Principales Ingredientes Tradicionales.

Admitiendo que el modelo matemático anteriormente descrito es representativo de la industria del balanceado del país, entonces lo que es válido para la producción de una tonelada de concentrado será equivalente a lo necesario para la totalidad de lo requerido para la industria en su conjunto. Si partimos del hecho de que hacia 1986 la producción interna de concentrados de Panamá era de 130,000 tons anuales, una demanda efectiva de yuca de un 23.1% en avicultura posibilitará el consumo industrial de 30,000 tons de yuca deshidratada. Por arribar a este volumen de yuca seca será necesario la generación de cuando menos 75,300 tons de yuca fresca (220% adicional respecto a los niveles actuales), y 5,800 has adicionales dedicadas a este cultivo ^{4/}.

^{4/} Este cálculo está basado en un factor de conversión de yuca fresca a deshidratada de 2.51, y un rendimiento medio de yuca fresca de 13 ton/ha (Ríos y Aguilar, 1986).

Con la incorporación eficiente de yuca deshidratada en las raciones balanceadas ello provoca un desplazamiento proporcional en términos de los cereales maíz y sorgo, del orden de las 20,848 tons para el primero y 9,868 tons para el segundo (total: 30,716 tons). En otras palabras, por cada tonelada de harina de yuca empleada en las raciones animales cabría esperar una reducción de 1.02 tons de cereales ^{5/}. Entre 1979 y 1983 Panamá se vió obligado a la importación media anual de 35,000 tons de maíz para abastecer sus necesidades internas, requiriendo de un volumen monetario cercano a los US\$6 millones anuales para cubrir dichas adquisiciones. Consecuentemente, de poderse generar internamente la producción de yuca antes citada sería perfectamente posible la sustitución de casi un 88% de las necesidades de importación de maíz, con los consiguientes ahorros en divisas ^{6/}.

Haciendo un esfuerzo adicional en cuantificar la demanda de yuca para los años próximos, se tomó en cuenta lo ya visto en secciones anteriores en el sentido de que el consumo interno de carne de ave creció entre 1974 y 1983 a un ritmo promedio del 9.8% anual, mientras que el de huevo hizo lo propio a un 5.9% anual. Ello se debió seguramente a un efecto conjunto en los ingresos per-cápita de la población panameña, los que aumentaron durante ese mismo período a 1.3% anual, al tiempo que la población total crecía al 2.8% anual, y a que los precios relativos a nivel del consumidor final han venido favoreciendo a la avicultura en relación a productos como la carne de res y de cerdo.

Situándonos entonces en una hipótesis conservadora sobre las perspectivas de la industria avícola nacional, podríamos suponer de un crecimiento al menos del 6% anual hasta 1990, por lo que el consumo de concentrados se situaría en dicho año al nivel de las 164,000 tons

^{5/} En este balance no se tomó en cuenta la reducción en la utilización del subproducto del trigo, acemite, el cual también vería reducida su demanda anual en 9,658 tons.

^{6/} Esto es sobre la base de que la reducción en la demanda de sorgo de acuerdo al modelo, pueda ser agregada al ahorro en maíz importado, utilizando en cambio la totalidad de la oferta interna de sorgo para de esta forma estimular también al productor nacional de este grano.

anuales, implicando una demanda efectiva por yuca deshidratada de 37,884 tons anuales (ello supone una producción en fresco de 95,089 tons, ó 7,315 has adicionales). Dada la relación entre yuca seca y los cereales maíz y sorgo de 1:1.02, al entrar aquella y desplazar a éstos en las formulaciones de costo mínimo, deberíamos esperar entonces un ahorro de 38,642 tons en importaciones de maíz por un monto a precios actuales de US\$6.6 millones. En adición, dado el menor costo de las raciones cuando interviene la yuca (en promedio de un 2.61%), esta reducción llevada a la industria en su conjunto posibilitaría beneficios de US\$1:133,000 a ser distribuidos entre los consumidores de raciones y los propios fabricantes de las mismas.

En contraposición se necesitará de mayores cantidades de fuentes proteicas, especialmente por la vía de la pasta de soya y de gluten de maíz. De acuerdo con los resultados obtenidos, los requerimientos promedios adicionales de estos productos para las dietas en avicultura serán de un 4.7% más por cada 100 kgs, con lo que llevada esta cifra a su nivel agregado nos implica 7,700 tons adicionales a un costo de más de US\$1:848,000.

Consecuentemente, un primer balance sobre las ventajas de un estímulo a la producción y utilización de yuca en Panamá nos arroja un resultado positivo en términos de los beneficios derivados de un menor costo en la fabricación de alimentos concentrados, así como un saldo neto favorable en materia de divisas por conceptos de ahorros en las importaciones de cereales y oleaginosas. La combinación de estos dos factores nos genera un resultado positivo cercano a los US\$6 millones hacia 1990.

Referencias y Lecturas Adicionales

- Banco Interamericano de Desarrollo. Informe Sobre el Sector Agropecuario de Panamá, enero 1982.
- Byerlee, Derek. Comparative Advantage and Policy Incentives for Wheat Production in Ecuador. CIMMYT's Economics Program, Working Paper No. 01/85.
- Byerlee, D. y J. Longmire. Comparative Advantage and Policy Incentives for Wheat Production in Rainfed and Irrigated Areas of Mexico. CIMMYT's Economics Program. Working Paper No. 01/86, Marzo 1986.
- Contraloría General de la República, Dirección de Estadísticas y Censos. Censos Nacionales de 1980, Cuarto Censo Nacional Agropecuario de 1980.
- Contraloría General de la República, Dirección de Estadísticas y Censos. Hoja de Balance de Alimentos, Años 1979-1982, Sección-352 Consumo.
- Contraloría General de la República, Dirección de Estadísticas y Censos. Panamá en Cifras, noviembre 1984.
- F.A.O. Anuarios FAO de Comercio, Vol. 38, 1984.
- F.A.O. Food Balance Sheets, 1984.
- F.A.O. Perspectivas Alimentarias, marzo de 1986, pág. 26-28.
- Gómez G., G., J. Santos N., y M. Valdivieso G. Utilización de Raíces y Productos de Yuca en Alimentación Animal. Del libro "Yuca: Investigación, Producción y Utilización", PNUD-CIAT, 1982, Pág. 539-561.
- Hillier, F.S. y G.J. Lieberman. Operations Research. Holden-Day Inc. Second Edition, 1974.
- Hubbard Farms. Management Guide for the Hubbard Golden Comet, 1979.
- Hubbard Farms. Management Guide for the Hubbard Broilers, 1983.
- Instituto de Mercadeo Agropecuario, Panamá. Dirección de Mercadeo Internacional, 1985.
- International Monetary Fund. International Financial Statistics, Yearbook 1984.
- Janssen, W.G. Market Impact on Cassava's Development Potential in the Atlantic Coast Region of Colombia, CIAT, 1986.
- Janssen, W. y C. Wheatley. Urban Cassava Markets: The Impact of Fresh Root Storage, Food Policy, August 1985, Pág. 265-277.

Ministerio de Desarrollo Agropecuario, Panamá. Atlas Nacional de Panamá, 1975; 1976.

Ríos, Miguel y J. Aguilar. Diagnóstico de la Producción de la Yuca en el Distrito de Ocú y Corregimiento de Chupampa. IDAP, 1986.

Ríos, Miguel y J. Aguilar M. Estudio de Factibilidad Económica para Plantas de Secado Natural de Yuca en el Area de Ocú. IDIAP, 1986.

Saez, Roberto R. Panamá: Aspectos Macroeconómicos y Evaluación de su Sector Agropecuario. CIAT, Mayo 1986.

Saez, Roberto R. Yuca Deshidratada: Producto con Excelentes Perspectivas Dentro de la Industria de Alimentos Balanceados de Panamá, CIAT, Agosto 1986.

Saez, Roberto R. Ventajas Comparativas en la Producción de Maíz, Sorgo y Yuca Deshidratada en Panamá. CIAT, Octubre 1986.

Scandizzo, Pasquale L. y Colin Bruce. Methodologies for Measuring Agricultural Price Intervention Effects. World Bank Staff Working Paper No. 394, junio 1980.

World Bank. Commodity Price Data. Commodity Studies and Projections Division, agosto 1986.

World Bank. World Development Report 1985.

Año	Consumo de Gobierno	Consumo Privado	Formación de Capital Fijo Bruto	Exportaciones millones de US\$	Importaciones	Producto Interno Bruto (PIB)	Producto Nacional Bruto (PNB)	PIB Real \$'80	PIB Real Per Capita (\$ '80)
1953	25.6	219.1	33.5	101.6	100.9	292.5	281.2	687.0	789.7
1954	27.2	242.0	32.6	102.6	100.9	307.2	290.5	711.6	799.6
1955	35.4	246.4	38.5	113.8	106.8	331.5	314.2	752.8	818.3
1956	40.7	260.6	49.8	111.3	119.2	347.4	330.1	792.0	833.7
1957	38.9	305.1	49.0	115.2	132.3	382.7	364.4	874.8	901.9
1958	43.3	295.8	52.6	106.4	127.8	381.6	370.2	881.7	881.7
1959	45.2	306.7	65.1	115.4	135.6	403.7	391.4	938.1	910.8
1960	46.9	322.9	61.4	127.3	149.1	415.8	403.4	994.6	938.3
1961	49.8	343.3	80.4	146.3	164.1	463.7	453.2	1,102.5	1,011.5
1962	55.9	360.8	85.4	179.5	190.3	504.8	495.6	1,193.4	1,056.1
1963	67.1	407.3	96.6	197.0	221.7	559.5	550.8	1,295.3	1,107.1
1964	65.3	448.1	87.8	210.8	225.6	600.8	595.4	1,352.7	1,127.3
1965	72.4	484.9	100.1	240.2	253.4	659.9	644.1	1,476.6	1,190.8
1966	86.7	492.9	142.1	268.2	286.0	719.0	702.7	1,588.5	1,250.8
1967	102.6	536.2	152.7	301.7	308.2	800.7	778.0	1,724.4	1,316.3
1968	109.7	551.8	173.5	330.0	322.0	861.4	836.1	1,844.7	1,366.4
1969	118.2	614.9	200.7	362.9	373.3	945.4	920.1	2,000.4	1,439.1
1970	149.8	654.7	255.6	390.1	424.7	1,045.8	1,019.4	2,139.6	1,496.2
1971	164.0	716.1	300.7	423.0	477.1	1,157.0	1,125.7	2,326.5	1,571.9
1972	192.1	766.2	383.0	466.9	534.9	1,297.8	1,264.1	2,472.9	1,626.9
1973	213.6	892.1	410.3	533.0	600.6	1,472.5	1,430.2	2,634.1	1,677.8
1974	265.4	1,237.4	422.1	766.4	932.9	1,834.7	1,779.7	2,703.2	1,668.6
1975	291.8	1,173.6	568.9	867.0	1,006.1	1,934.2	1,913.6	2,720.2	1,619.2
1976	313.4	1,175.9	632.9	840.7	987.6	2,004.3	1,950.7	2,711.6	1,576.5
1977	337.2	1,407.7	482.6	925.1	1,012.4	2,170.8	2,109.8	2,835.2	1,601.8
1978	372.2	1,513.0	647.1	973.7	1,110.7	2,458.2	2,409.4	3,019.2	1,668.1
1979	567.2	1,693.8	661.2	1,124.8	1,371.3	2,800.2	2,697.4	3,091.0	1,670.8
1980	680.5	2,009.5	866.4	1,567.1	1,685.2	3,558.8	3,448.8	3,558.8	1,873.1
1981	812.9	2,107.4	1,079.6	1,632.0	1,841.5	3,878.0	3,799.4	3,707.6	1,911.1
1982	962.6	2,311.5	1,185.4	1,689.6	1,869.4	4,278.9	4,140.0	3,911.1	1,917.2
1983	941.5	2,480.0	917.8	1,709.5	1,691.4	4,373.7	4,375.9	3,925.5	1,878.2
1984	881.5	2,895.1	811.2	1,644.9	1,686.2	4,540.5	4,472.2	3,908.4	1,834.9
1985								4,036.6	1,851.7

Apéndice 1.2: Finanzas Públicas de Panamá, 1953-1985.

Año	Ingresos Públicos	Egresos Públicos (Consumo + Inversión)	Déficit Gubernamental (Neto) ----- millones de US\$ -----	Deuda Pública Interna	Deuda Pública Externa	Déficit de Gobierno como % del PIB
1953	41.4	42.1	- 0.7	30.0		0.2
1954	42.7	43.9	- 0.6	30.4		0.2
1955	45.3	46.6	- 1.4	32.4		0.4
1956	48.8	54.6	- 5.8	40.6		1.7
1957	50.7	51.5	- 0.9	42.5		0.2
1958	52.9	64.4	- 11.5	35.1		3.0
1959	51.6	55.9	- 4.2	46.8		1.0
1960	58.0	65.0	- 7.0	51.0		1.7
1961	62.9	78.0	- 15.5	56.3		3.3
1962	67.6	73.4	- 6.4	40.9		1.3
1963	69.1	85.4	- 16.3	68.1		2.9
1964	75.6	77.9	- 2.3	72.1		0.4
1965	85.5	89.9	- 3.4	71.8		0.5
1966	100.4	107.2	- 6.8	71.5	68.3	0.9
1967	112.7	125.7	- 13.0	83.6	71.3	1.6
1968	119.4	127.7	- 8.3	97.7	70.8	1.0
1969	133.0	195.2	- 62.1	133.9	104.8	6.6
1970	160.2	209.3	- 49.1	144.9	140.6	4.7
1971	181.2	213.5	- 32.3	155.0	173.4	2.8
1972	197.9	303.5	-105.7	190.4	214.9	8.1
1973	226.0	370.7	-144.7	180.0	296.9	9.8
1974	271.4	466.6	-195.2	231.5	358.9	10.6
1975	297.1	445.1	-148.0	294.6	427.4	7.7
1976	281.6	445.8	-164.2	332.7	510.2	8.2
1977	343.1	433.4	- 90.3	330.5	614.0	4.2
1978	435.8	534.0	- 98.2	374.8	1,025.6	4.0
1979	539.0	814.2	-275.2	404.8	1,344.0	9.7
1980	695.3	886.1	-190.8	484.4	1,578.6	5.6
1981	826.1	1,058.5	-232.4	691.6	1,689.8	6.0
1982	1,055.0	1,395.1	-340.1	728.4	2,049.8	7.9
1983	1,122.0	1,173.0	- 51.0	897.1	2,175.1	1.2
1984	1,094.2	1,146.3	- 52.0	957.5	2,263.9	1.1
1985	997.2	1,008.9	- 11.7	1,055.2	2,265.5	

Fuente: International Financial Statistics, Yearbook 1985, I.M.F.

Apéndice 1.3. Política Monetaria de Panamá, 1953-1985:
Evolución del Circulante.

Año	Circulante Corriente Millones US\$	Deflactor del PIB	Circulante Real Millones US\$
1953	48.6	42.6	114.1
1954	51.1	43.2	118.3
1955	52.5	44.0	119.3
1956	56.3	43.4	129.7
1957	61.4	43.4	141.5
1958	65.2	43.3	150.6
1959	68.7	42.9	160.1
1960	70.3	41.8	168.2
1961	75.3	42.1	178.9
1962	86.9	42.3	205.4
1963	110.7	43.2	256.3
1964	104.9	44.4	236.3
1965	124.7	44.7	278.9
1966	148.9	45.3	328.7
1967	180.7	46.4	389.4
1968	206.5	46.7	442.2
1969	196.5	47.3	415.4
1970	256.3	49.1	522.0
1971	302.2	50.5	598.4
1972	392.9	53.0	741.3
1973	444.5	57.5	773.0
1974	530.2	64.2	825.9
1975	547.8	70.2	780.3
1976	578.0	73.4	787.5
1977	672.5	76.8	875.7
1978	832.7	82.9	1,004.5
1979	1,043.5	90.6	1,151.8
1980	1,315.7	100.0	1,315.7
1981	1,560.8	104.6	1,492.2
1982	1,749.1	109.6	1,595.9
1983	1,748.2	111.4	1,569.3
1984	1,862.9	116.2	1,603.2
1985	1,952.5	n/d	n/d

Fuente: International Financial Statistics, Yearbook 1985,
I.M.F.

Apéndice 1.4. Comportamiento del Nivel General de Precios al Consumidor en Panamá, U.S.A y Tipo de Cambio, 1953-1985.

Año	Nivel Precios al Consumidor Panamá	Nivel Precios al Consumidor U.S.A.	Tipo de Cambio Panamá
1953	45.2	32.5	1.0
1954	45.0	32.6	1.0
1955	44.9	32.5	1.0
1956	44.8	33.0	1.0
1957	44.8	34.2	1.0
1958	44.6	35.1	1.0
1959	44.7	35.4	1.0
1960	44.8	35.9	1.0
1961	45.0	36.3	1.0
1962	45.3	36.7	1.0
1963	45.5	37.2	1.0
1964	46.6	37.6	1.0
1965	46.8	38.2	1.0
1966	47.0	39.4	1.0
1967	47.6	40.5	1.0
1968	48.3	42.2	1.0
1969	49.2	44.5	1.0
1970	50.8	47.1	1.0
1971	51.8	49.1	1.0
1972	54.5	50.8	1.0
1973	58.3	53.9	1.0
1974	68.1	59.8	1.0
1975	71.8	65.3	1.0
1976	74.7	69.1	1.0
1977	78.1	73.6	1.0
1978	81.4	79.2	1.0
1979	87.9	88.1	1.0
1980	100.0	100.0	1.0
1981	107.3	110.4	1.0
1982	111.9	117.1	1.0
1983	114.2	120.9	1.0
1984	116.0	126.1	1.0
1985	117.2	130.5	1.0

Fuente: International Financial Statistics, Yearbook 1985, I.N.F.

Año	Exportaciones Totales	Bananas	Petroleo Refinado	Camarón	Azúcar	Importaciones (c.i.f.)	Importaciones (f.o.b.)	Petroleo Crudo
				millones de US\$				
1953	25.54	16.32		2.13	0.38	77.5	70.4	
1954	30.71	22.12		2.28	0.38	79.6	72.3	
1955	35.54	26.18		2.72	-	82.4	74.9	
1956	30.73	22.31		4.43	0.01	91.3	83.0	
1957	35.44	24.42		6.18	0.42	108.8	99.0	
1958	32.84	21.89		5.61	0.64	103.0	93.7	
1959	35.74	23.52		5.10	0.58	106.9	98.3	
1960	27.76	18.16		4.99	0.40	119.5	109.2	
1961	30.22	20.13		5.85	0.78	136.4	124.2	
1962	47.98	20.13	13.85	7.94	0.53	159.7	145.2	16.79
1963	60.00	25.07	23.61	6.17	1.56	180.7	162.8	33.03
1964	69.66	29.13	24.94	7.41	2.49	181.4	165.4	33.72
1965	79.26	39.62	23.71	7.78	2.12	208.4	189.6	38.46
1966	89.54	44.54	25.91	8.97	1.56	234.8	214.5	46.08
1967	93.86	49.50	22.92	9.19	3.91	250.7	229.3	45.33
1968	99.83	57.55	18.86	9.73	4.62	266.3	243.3	50.38
1969	110.52	63.44	24.06	9.74	5.44	293.6	278.7	58.60
1970	109.50	61.83	21.47	10.17	4.97	357.0	326.4	59.66
1971	116.54	62.90	25.13	11.95	6.33	395.8	359.0	63.68
1972	122.63	64.70	21.54	14.63	5.91	440.5	401.1	65.08
1973	137.77	63.82	24.40	16.71	8.78	502.2	454.0	88.08
1974	210.51	49.26	86.30	15.18	27.49	822.4	755.7	270.95
1975	286.45	59.51	128.26	19.01	49.36	892.1	815.6	323.02
1976	238.21	61.73	66.33	33.52	26.42	848.3	779.7	235.63
1977	251.03	66.45	68.26	29.98	21.89	861.2	777.8	255.09
1978	256.41	71.93	60.11	30.25	20.35	942.4	844.9	208.14
1979	302.87	65.68	72.38	45.00	26.13	1,183.8	1,062.9	301.75
1980	360.49	61.57	81.80	43.69	65.81	1,448.6	1,288.9	386.18
1981	328.14	69.19	58.44	42.74	52.61	1,540.1	1,393.0	346.95
1982	374.81	65.98	70.10	52.90	23.68	1,570.2	1,407.4	364.05
1983	321.05	74.99	36.34	51.39	41.31	1,411.9	1,266.2	324.23
1984	276.03	74.65	5.26	46.67	33.30	1,423.1	1,269.8	288.58
1985	335.35	78.08	19.96	59.77	27.33			236.39

Fuente: International Financial Statistics, Yearbook 1985, I.M.F.

Apéndice 1.6. Balanza de Pagos, Panamá, 1955-1985.

Año	Balanza Comercial	Otros Bienes Servicios e Ingresos Netos	Cuenta Corriente	Déficit de Balanza Comercial como % del PIB
		millones de US\$		
1955	- 21.4	17	- 11	6.5
1956	- 34.2	12	- 20	9.8
1957	- 51.7	21	- 35	13.5
1958	- 53.7	20	- 29	14.1
1959	- 54.1	20	- 32	13.4
1960	- 69.7	37	- 32	16.8
1961	- 82.4	54	- 24	17.8
1962	- 84.7	64	- 21	16.8
1963	- 91.2	66	- 25	16.3
1964	- 86.2	65	- 21	14.3
1965	- 99.9	66	- 30	15.1
1966	-144.4	72	- 40	15.9
1967	-123.1	96	- 26	15.4
1968	-128.6	113	- 15	14.9
1969	-152.6	123	- 29	16.1
1970	-200.7	133	- 64	19.2
1971	-226.1	148	- 73	19.5
1972	-262.5	159	- 98	20.2
1973	-296.2	189	-111	20.1
1974	-509.8	289	-224	27.8
1975	-492.2	328	-169	25.4
1976	-514.3	342	-176	25.7
1977	-501.9	349	-155	23.1
1978	-560.2	352	-208	22.8
1979	-730.1	407	-311	25.7
1980	-727.0	402	-311	28.4
1981	-775.0	800	+ 56	20.0
1982	-633.0	455	- 51	14.8
1983	-648.0	711	+247	14.8
1984	-824.0	704	- 70	18.1
1985	-654.0	591	+ 21	

Fuente: International Financial Statistics, Yearbook 1985,
I.M.F.

Apéndice 2.1: Composición del Producto Interno Bruto, por Sectores Económicos.

SECTOR	1950-52	1959-61	1969-71	1979 %	1980	1981	1982	1983
a) Agricultura	27.2	23.7	18.2	14.2	11.6	12.1	11.3	11.9
b) Manufactura, Minería, Electricidad	10.3	13.4	17.4	17.8	15.9	15.2	14.9	15.1
c) Construcción	4.2	5.4	6.1	8.0	8.3	8.3	9.4	6.5
d) Comercio y Servicios	50.5	50.4	50.1	54.0	52.5	52.2	51.9	55.7
e) Servicios Prestados al Área del Canal	7.8	7.1	8.2	6.0	11.7	12.2	12.5	10.8

Fuente: Contraloría General de la República, Dirección de Estadísticas y Censos. Años Recientes: Panama en Cifras, noviembre, 1984.

Apéndice 2.2: Composición del Producto Interno Bruto del Sector Agropecuario.

	Agricultura	Ganadería	Otros
	-----	% -----	
1960-62	75.3	18.9	5.8
69-71	77.9	17.4	4.7
78-80	76.7	18.4	4.9
1982	65.2	28.4	6.4
1983	65.9	27.8	6.3
1984	65.2	28.3	6.5

Fuente: Contraloría General de la República, Dirección de Estadísticas y Censos. Años Recientes: Panamá en Cifras, noviembre, 1984.

AÑO	Exportaciones Productos Agropecuarios (a) (000 US\$)	Porcentaje Sobre Total Exportado (%)	Importaciones Productos Agropecuarios (b) (000 US\$)	Porcentaje Sobre Total Importado (%)	Saldo Bruto (a - b) (000 US\$)	Importaciones Fertilizantes, Pesticidas, Maq. Agrícola (000 US\$)	Saldo Neto del Comercio Agropecuario (000 US\$)
1969	71,037	65.2	23,170	8.7	47,867	8,264	39,603
1970	71,592	65.4	28,227	8.6	43,365	12,640	30,725
1971	73,617	63.2	40,709	11.3	32,908	15,405	17,503
1972	78,999	64.4	38,153	9.5	40,846	16,903	23,943
1973	82,124	59.6	45,697	10.1	36,427	19,485	16,942
1974	87,741	41.7	56,142	7.4	31,599	35,761	(4,162)
1975	120,439	42.0	65,890	8.1	54,549	41,904	12,645
1976	103,060	45.5	62,900	7.5	40,160	32,404	7,756
1977	108,414	44.6	71,791	9.2	36,623	26,603	10,020
1978	122,288	50.1	73,004	8.6	49,284	27,319	21,965
1979	128,753	44.2	95,559	9.0	33,194	35,532	(2,338)
1980	170,938	48.8	120,114	9.3	50,824	41,004	9,820
1981	164,896	52.0	132,761	8.6	32,135	50,499	(18,364)
1982	136,041	34.9	124,389	8.8	11,654	44,777	(33,123)
1983	165,582	54.5	124,138	9.8	41,444	32,717	8,727

Fuente: FAO 1983, Anuario FAO de Comercio, Vol. 37.

Apéndice 2.4: PANAMA: Exportaciones de Productos Agropecuarios y Pesqueros, 1969 - 1983.

ANO	Productos Apropecuarios Totales	Frutas y Hortalizas	Azúcar	Café 000 US\$	Carnes	Productos Lácteos	Productos Pesqueros
1969	71,037	61,384	6,043	1,470	1,307	13	n/d
1970	71,592	60,922	5,689	1,717	2,448	8	11,019
1971	73,617	63,142	6,775	1,553	1,381	142	13,254
1972	78,999	65,662	6,473	2,752	3,149	6	16,786
1973	82,124	65,713	9,469	2,356	1,595	216	22,285
1974	87,741	51,916	28,636	2,755	1,806	257	18,803
1975	120,439	61,479	50,885	3,101	1,569	345	22,631
1976	103,060	63,674	26,670	4,713	3,807	743	43,748
1977	108,414	70,568	21,955	7,605	1,471	1,909	47,944
1978	122,288	76,134	20,331	11,981	490	3,008	38,785
1979	128,753	70,591	26,982	13,928	1,564	4,035	56,904
1980	170,938	65,763	69,702	13,024	3,125	7,832	66,040
1981	164,896	75,321	52,650	14,282	5,094	7,548	57,716
1982	136,041	70,652	24,515	15,104	9,352	3,888	60,000
1983	165,582	81,458	42,607	18,963	4,110	3,586	72,569

Fuente: FAO 1983, Anuario FAO de Comercio, Vol. 37.

Apéndice 2.5: PANAMA: Importaciones de Productos Agropecuarios, 1969 - 1983.

AÑO	Productos Agropecuarios Totales	Cereales	Frutas y Hortalizas	Carnes	Productos Lácteos	Alimentos Animales	Aceites Vegetales
				000 US\$			
1969	23,170	5,374	4,785	3,221	2,764	748	532
1970	28,227	4,863	5,954	4,106	3,250	1,192	2,594
1971	40,709	11,735	6,918	4,128	3,885	1,646	4,956
1972	38,153	8,177	7,593	4,762	5,373	1,950	3,581
1973	45,697	12,765	8,407	6,118	4,511	2,757	2,360
1974	56,142	15,286	9,488	6,937	8,840	3,653	1,400
1975	65,890	17,037	8,509	6,633	8,327	2,411	9,191
1976	62,900	14,738	11,535	7,991	6,813	3,116	6,195
1977	71,791	15,691	13,678	7,719	9,012	3,606	10,209
1978	73,004	14,234	15,466	8,026	8,715	3,951	7,836
1979	95,559	18,941	19,066	10,170	9,705	5,587	13,741
1980	120,114	23,800	21,254	12,427	16,920	6,683	17,016
1981	132,761	32,931	27,084	14,245	9,786	11,828	11,932
1982	124,387	26,156	23,566	14,288	13,504	9,819	12,847
1983	124,138	24,170	22,602	12,236	15,247	9,425	13,559

Fuente: FAO 1983, Anuario FAO de Comercio, Vol. 37

Apéndice 2.6: PANAMA: Participación de las Importaciones Respecto a las Calorías, Proteínas y Grasas Demanda por su Población, 1960/62 - 1982.

AÑOS	Importaciones		
	CALORIAS (%)	PROTEINAS (%)	GRASAS (%)
1960-62	20.6	22.2	20.7
1963-65	18.8	21.2	20.1
1966-68	21.0	24.1	22.7
1969-71	30.3	31.4	39.5
1972	34.8	38.8	38.2
1973	31.2	32.2	28.2
1974	28.5	27.3	45.3
1975	28.8	29.2	42.9
1976	32.1	26.8	52.5
1977	31.2	26.6	54.0
1978	27.9	25.6	39.7
1979	41.2	28.8	56.8
1980	44.6	31.8	80.0
1981	38.8	32.2	57.1
1982	29.9	28.5	49.4
Prom. 1960-71	22.7	24.7	25.8
Prom. 1972-82	33.5	29.8	49.5

Fuente: Dirección de Estadística y Censo. Estadísticas Panameñas: Situación Económica, Hoja de Balance de Alimentos, Años 1979-1982, Sección 352 Consumo.

Apéndice 2.7 PANAMA: Yuca y Arroz; Número de Explotaciones, Superficie Cosechada, Niveles de Producción, Porcentaje Comercializado y Valor de la Producción Vendida, Según Principales Provincias en el Año Agrícola 1980/81.

YUCA	Número Explotaciones	Superficie Cosechada (has)	Producción Obtenida (tons)	% Comercializado	Valor de la Producción Vendida (US\$)
Coclé	10,592	1,036	5,396	6.4	25,418
Chiriquí	7,461	1,730	2,069	25.4	61,503
Herrera	5,264	901	3,790	48.9	104,046
L. Santos	3,584	223	982	9.6	9,105
Panamá	10,879	972	4,093	20.7	72,648
Veraguas	13,149	1,143	5,616	11.3	34,232
Sub-Total	50,929	6,005	21,945		306,952
Otros (%)	8.4	15.7	10.0		17.4
=====					

ARROZ

Coclé	10,586	15,432	26,287	73.9	5:205,098
Chiriquí	6,846	29,581	83,894	90.6	17:920,815
Herrera	7,067	8,393	14,506	57.5	2:028,409
L. Santos	6,051	7,277	9,183	38.8	950,525
Panamá	7,023	7,952	9,063	42.3	988,876
Veraguas	17,620	17,866	21,563	37.9	2:065,038
Sub-Total	55,193	86,507	164,495		29:158,761
Otros (%)	9.0	6.5	3.6		1.5

Fuente: Censo Nacional de 1980, Cuarto Censo Nacional Agropecuario, Dirección de Estadística y Censo, 1984.

Apéndice 2.8 PANAMA: Maíz y Sorgo; Número de Explotaciones, Superficie Cosechada, Niveles de Producción, Porcentaje Comercializado y Valor de la Producción Vendida, Según Principales Provincias en el Año Agrícola 1980/81.

MAIZ	Número Explotaciones	Superficie Cosechada (has)	Producción Obtenida (tons)	% Comercializado	Valor de la Producción Vendida (US\$)
Coclé	10,163	3,928	2,742	20.8	128,339
Chiriquí	9,270	8,289	8,394	45.0	735,207
Herrera	9,524	5,691	5,676	30.9	381,957
L. Santos	8,121	11,823	16,576	67.7	2:479,014
Panamá	9,559	6,672	5,565	41.8	451,269
Veraguas	24,017	10,112	9,245	12.5	232,072
Sub-Total	70,654	46,515	48,199		4:407,858
Otros (%)	6.6	10.9	10.7		15.4

SORGO

Coclé	20	953	2,542	99.9	496,737
Chiriquí	339	3,609	7,054	98.2	1:194,268
Herrera	71	967	2,206	98.8	436,075
L. Santos	180	2,841	6,448	95.5	1:248,044
Panamá	42	344	622	99.1	131,502
Veraguas	21	61	129	68.5	16,396
Sub-Total	673	8,775	19,000		3:523,022
Otros (%)	1.3	0.4	0.2		0.1

Fuente: Censo Nacional de 1980, Cuarto Censo Nacional Agropecuario, Dirección de Estadística y Censo, 1984.

Apéndice 2.9 PANAMA: Frijol y Name; Número de Explotaciones, Superficie Cosechada, Niveles de Producción, Porcentaje Comercializado y Valor de la Producción Vendida, Según Principales Provincias en el Año Agrícola 1980/81.

FRIJOL	Número Explotaciones	Superficie Cosechada (has)	Producción Obtenida (tons)	% Comercializado	Valor de la Producción Vendida (US\$)
Coclé	2,475	523	135.3	13.0	7,587
Chiriquí	3,805	2,011	764.8	48.1	120,488
Herrera	2,553	525	170.6	24.1	18,290
L. Santos	1,653	473	255.9	56.5	75,289
Panamá	3,282	941	341.6	30.5	39,340
Veraguas	7,736	2,497	622.1	13.0	33,587
Sub-Total	21,504	6,970	2,290.3		294,581
Otros (%)	6.7	6.4	7.5		8.1
=====					

NAME

Coclé	2,813	104	836.6	16.9	34,378
Chiriquí	805	59	309.5	24.7	20,455
Herrera	2,623	1,152	3,685.0	66.2	528,482
L. Santos	1,888	126	462.8	25.1	32,305
Panamá	4,153	476	1,783.4	41.2	169,862
Veraguas	6,431	543	1,655.5	22.6	87,958
Sub-Total	18,713	2,460	8,732.8		873,440
Otros (%)	9.5	20.2	13.6		15.2

Fuente: Censo Nacional de 1980, Cuarto Censo Nacional Agropecuario, Dirección de Estadística y Censo, 1984.

Apéndice 2.10 PANAMA: Caña de Azúcar; Número de Explotaciones, Superficie Cosechada, Niveles de Producción, Porcentaje Comercializado y Valor de la Producción Vendida, Según Principales Provincias en el Año Agrícola 1980/81.

CAÑA DE AZUCAR	Número Explotaciones	Superficie Cosechada (has)	Producción Obtenida (tons)	% Comercializado	Valor de la Producción Vendida (US\$)
Coclé	3,371	13,445	559,112	54.7	5:229,551
Chiriquí	1,528	6,284	332,612	12.4	561,578
Herrera	1,510	12,045	304,507	84.4	4:372,365
L. Santos	1,367	1,045	23,974	38.7	146,982
Panamá	1,448	7,880	343,637	19.7	535,967
Veraguas	4,941	12,550	502,158	97.1	8:295,431
Sub-Total	14,165	53,249	2:066,000		19:141,874
Otros (%)	5.5	0.23	9.1		0.0

Fuente: Censo Nacional de 1980, Cuarto Censo Nacional Agropecuario, Dirección de Estadística y Censo, 1984.

Apéndice 2.11 PANAMA: Existencia de Animales por Clase, Según Principio

PROVINCIA	VACUNOS		PORCINOS		GALLINAS	
	Explotación	Cabezas	Explotación	Cabezas	Explotación	Cabezas
Coclé	3,959	101,611	3,544	14,390	17,786	822,943
Chiriquí	6,905	372,858	9,706	37,611	24,170	670,633
Herrera	4,352	137,145	5,114	26,522	10,867	361,777
L. Santos	5,658	288,963	5,229	36,050	11,679	458,897
Panamá	3,761	169,760	3,475	47,604	22,624	2:599,934
Veraguas	6,964	275,670	8,907	36,909	23,391	701,199
Sub-Total	31,599	1:346,007	35,975	199,086	110,517	5:615,383
Otros (%)	5.8	5.6	7.0	8.5	7.2	6.5

Fuente: Censo Nacional de 1980, Cuarto Censo Nacional Agropecuario, Dirección de Estadística y Censo, 1984.

Apéndice 2.12: PANAMA: Series Históricas de la Evolución a los Niveles de Producción de Arroz, Maíz, Frijol, Café, Tabaco, Caña de Azúcar, Yuca y Sorgo en el País: 1974 - 1983.

Año	Arroz en Cáscara	Maíz en Grano	Frijol Grano	Café Pilado	Tabaco	Caña de Azúcar	Yuca	Sorgo
	----- tons -----							
1974	178,372	59,362	4,055	4,504	802.9	1:722,682	38,569	6,804
1975	184,836	65,214	4,196	4,804	1,111.3	1:924,625	39,324	9,997
1976	144,466	63,971	3,298	4,677	1,283.7	2:396,369	39,575	11,340
1977	186,229	79,697	4,032	5,516	1,392.5	2:756,981	39,078	14,742
1978	162,383	64,492	3,266	6,146	1,510.5	2:624,076	38,275	15,354
1979	160,546	63,318	3,715	6,101	1,397.1	2:386,934	38,384	40,797
1980	170,648	53,946	2,477	7,271	2,145.5	2:062,156	34,620	35,462
1981	195,160	56,972	3,343	7,063	1,619.3	2:590,510	32,770	23,719
1982	176,313	61,902	1,982	8,142	1,415.2	2:093,908	34,186	15,917
1983	199,415	68,616	3,298	8,854	1,143.1	2:134,551	34,357	26,254
Promedio	175,837	63,749	3,366	6,308	1,382.1	2:269,279	36,914	20,039

Fuente: Banco Interamericano de Desarrollo: Informe Sobre el Sector Agropecuario de Panamá, Enero 1982, y Panamá en Cifras, 1979-83, Noviembre, 1984.

Apéndice 2.13: PANAMA: Series Históricas de la Evolución en los Niveles de Existencias Vacunas, Porcinas y Avícolas; Número de Cabezas Faenadas de Vacunos y Porcinos, y Niveles de Producción de Vacunos, Porcinos, Huevo y Leche en el País: 1974 - 1983.

AÑO	<u>Existencias</u>			<u>Cabezas Faenadas</u>		<u>Producción</u>			
	<u>Vacunos</u>	<u>Porcinos</u>	<u>Gallinas</u>	<u>Vacunos</u>	<u>Porcinos</u>	<u>Carne de Res en Canal</u>	<u>Carne de Cerdo en Canal</u>	<u>Huevo</u>	<u>Leche</u>
	-----000 Cabezas-----			-----000 Cabezas-----		(tons)	(tons)	(000 unidades)	(000 lts)
1974	1,332.8	175.0	3,802.2	206.6	85.6	40,900	3,800	215:532.5	61:713.6
1975	1,347.9	166.1	3,704.3	222.4	87.1	44,600	3,900	239:262.5	70:337.5
1976	1,361.2	179.0	4,276.7	241.1	85.9	48,100	3,800	279:171.7	72:836.3
1977	1,373.9	201.7	4,422.0	239.8	96.1	47,700	4,300	256:407.8	83:366.2
1978	1,395.0	204.0	4,871.6	216.3	103.7	41,400	4,600	307:739.3	90:626.2
1979	1,436.7	189.9	4,913.7	196.5	105.0	37,558	4,700	295:431.6	90:716.8
1980	1,404.9	211.5	4,796.7	214.9	120.7	40,972	5,377	283:954.3	91:179.2
1981	1,426.0	217.6	6,004.4	238.7	132.5	45,428	5,903	293:864.3	89:551.7
1982	1,456.3	205.7	4,544.6	276.6	130.0	52,108	5,792	347:431.2	89:759.0
1983	1,458.7	197.0	5,702.0	276.5	122.1	51,764	5,440	365:848.0	85:017.0

Fuente: Banco Interamericano de Desarrollo: Informe Sobre el Sector Agropecuario de Panamá, Enero 1982, y Panamá en Cifras, 1979-83, Noviembre, 1984.

Apéndice 2.14: PANAMA: Precios Recibidos por el Productor Agropecuario entre 1971 y 1983.

Producto	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
a) Arroz en Cáscara 1a. Clase, ¢/lb	5.86	5.84	5.88	6.98	8.92	9.07	9.49	8.98	9.16	10.60	11.18	10.59	10.75
Arroz Limpio, US\$/ton	193.8	193.1	194.4	230.8	294.9	299.9	313.8	296.9	302.9	350.5	369.7	350.2	355.5
b) Maíz Grano, ¢/lb	4.78	4.75	5.02	6.66	8.05	8.12	8.13	7.38	7.74	9.32	9.61	10.05	10.01
Maíz Grano, US\$/ton	105.4	104.7	110.7	146.8	177.5	179.0	179.2	162.7	170.6	205.5	211.9	221.6	220.7
Relación Arroz/Maíz	1.84	1.84	1.76	1.57	1.66	1.68	1.75	1.82	1.78	1.71	1.74	1.58	1.61
Name, ¢/lb	5.10	5.36	5.95	7.74	8.69	9.42	9.89	8.75	9.08	9.60	11.60	10.95	13.08
Papa, ¢/lb	6.74	7.22	7.79	8.92	9.82	10.28	12.28	8.25	9.75	9.64	9.78	9.20	7.52
Yuca, ¢/lb	2.08	2.18	2.20	2.41	2.91	3.00	3.10	2.07	2.76	2.93	3.11	3.22	3.46
Yuca, US\$/ton	45.9	48.1	48.5	53.1	64.2	66.1	68.3	45.6	60.8	64.6	68.6	70.9	76.3
Banana Guineo, ¢/lb	0.78	0.79	0.78	0.86	0.96	1.00	1.11	0.76	0.96	1.04	1.08	1.01	0.94
Plátano, ¢/lb	1.38	1.36	1.54	1.71	2.05	2.30	2.54	2.01	1.90	2.11	2.04	2.17	1.73
Gallina, ¢/lb	0.49	0.52	0.54	0.62	0.70	0.71	0.72	0.70	0.71	0.76	0.94	0.95	0.92
Leche Fresca, ¢/botella	0.12	0.12	0.14	0.16	0.17	0.18	0.19	0.17	0.16	0.17	0.17	0.17	0.20
Queso: ¢/lb	0.32	0.33	0.36	0.39	0.46	0.50	0.55	0.36	0.54	0.55	0.62	0.57	0.54
Huevos: ¢/docena	0.56	0.59	0.60	0.69	0.72	0.71	0.73	0.66	0.67	0.77	0.88	0.84	0.80

Fuente: PANAMA en Cifras, Dirección de Estadísticas y Censos, 1984.

Apéndice 3.1: Evolución de los Consumos Per Cápita de Alimentos Básicos en la Dieta de Panamá, 1960-1983.

Año	Leche Pasteurizada	Lacteos Totales	Huevos	Carne de Res	Carne de Ave	Carne de Cerdo Kgs/año	Yuca	Papa	Plátano	Name	Trigo	Arroz	Maíz
1960	6.0	31.4	3.4	17.4	4.1	3.1	10.7	5.5	59.2	7.8	21.2	65.5	34.9
1961	6.6	34.6	4.3	19.5	4.1	3.0	12.0	6.4	59.3	8.9	23.7	66.7	38.1
1962	7.4	34.9	4.4	19.4	3.7	2.9	11.8	6.5	59.3	8.6	21.7	61.9	33.1
1963	7.9	37.3	4.9	19.2	3.5	2.9	11.6	6.6	59.1	8.6	23.6	64.8	36.6
1964	7.9	38.3	3.9	19.5	3.7	2.3	11.5	6.7	59.1	8.3	23.1	63.5	37.8
1965	9.1	40.8	3.9	20.7	4.1	2.3	11.8	7.0	59.4	8.7	21.3	60.8	33.7
1966	9.3	42.8	3.8	21.0	4.2	2.6	11.9	6.4	59.2	8.8	24.2	67.8	37.9
1967	11.4	45.4	4.0	19.9	3.8	3.1	12.3	5.0	63.4	9.2	20.2	73.5	33.5
1968	12.6	34.6	3.9	19.7	4.0	2.3	12.6	6.0	68.5	10.0	23.8	63.2	30.8
1969	11.8	44.4	4.9	20.5	4.7	2.4	12.6	6.6	74.2	9.3	19.7	73.6	31.3
1970	10.8	39.1	4.1	20.4	5.0	2.7	22.0	4.0	77.3	6.7	16.6	65.8	24.5
1971	15.8	46.2	5.6	22.3	6.0	2.2	18.4	8.9	72.2	9.0	25.1	66.5	24.0
1972	10.8	44.3	7.0	22.4	5.6	2.1	18.8	7.7	71.7	9.0	25.5	51.3	17.3
1973	15.6	40.8	7.6	21.4	5.4	2.4	18.3	7.2	68.5	9.0	20.6	56.6	17.2
1974	14.5	31.3	6.1	20.5	5.8	2.4	17.9	7.4	75.0	9.0	16.5	74.9	29.7
1975	15.4	37.5	6.6	23.2	5.3	2.3	17.6	5.3	72.4	9.0	25.0	79.5	19.6
1976	15.2	37.3	7.4	24.0	6.6	1.9	17.3	6.9	71.5	8.8	22.5	45.9	18.6
1977	15.8	40.6	6.4	24.6	5.9	2.6	16.6	5.7	66.5	8.5	29.5	63.7	23.4
1978	17.3	45.1	8.0	22.2	6.6	2.3	15.9	4.5	61.3	8.1	24.4	52.9	18.0
1979	18.9	43.1	7.4	19.7	6.8	2.3	15.6	5.6	63.0	8.0	19.8	47.5	20.2
1980	20.4	44.6	7.0	21.1	10.8	4.2	13.1	7.5	92.3	9.7	19.1	50.4	23.9
1981	19.1	37.5	9.1	23.3	11.3	4.1	12.2	8.7	77.5	9.4	23.2	57.0	18.5
1982	19.5	39.7	7.9	24.6	10.1	3.5	12.3	7.0	74.8	9.6	20.8	46.7	25.7
1983	17.8	35.8	8.1	25.2	11.0	3.3	12.2	6.6	57.2	8.5	18.5	58.2	22.4
Tasa de Crecimiento (%)	5.12	0.43	3.98	1.06	4.86	0.56	1.09	0.36	0.90	0.22	-0.24	-1.13	-2.9

Fuente: Situación Económica: Hoja de Balance de Alimentos, varios años, Contraloría de la República, Panamá.

Apéndice 3.2: Niveles de Consumo Per Cápita Diarios de Calorías Totales, Importadas y de Algunos Carbohidratos en Panamá, 1960-1983.

Año	Calorías Totales	Calorías Importadas	Calorías Raíces y Tubérculos	Calorías Yuca	Calorías Plátano y Guineo	Calorías Importadas/ Totales (%)
1960	2,330	495	72	32	117	21.2
1961	2,487	511	81	36	117	20.5
1962	2,370	482	79	35	117	20.3
1963	2,442	507	80	35	117	20.8
1964	2,462	464	77	34	117	18.8
1965	2,370	420	80	35	117	17.7
1966	2,426	550	81	36	117	22.7
1967	2,484	489	82	37	126	19.7
1968	2,497	549	75	27	136	22.0
1969	2,560	497	85	38	148	19.4
1970	2,475	504	102	66	154	20.4
1971	3,136	1,181	105	55	143	37.7
1972	2,774	812	105	56	143	29.3
1973	2,422	760	105	55	135	31.4
1974	2,684	762	103	53	148	28.4
1975	2,758	793	98	53	142	28.8
1976	2,271	670	100	52	141	29.5
1977	2,689	849	95	50	131	31.6
1978	2,417	675	90	48	122	27.9
1979	2,306	844	90	47	124	36.6
1980	2,715	1,013	83	39	176	37.3
1981	2,648	1,113	82	36	148	42.0
1982	2,477	738	87	37	143	29.8
1983	2,402	736	80	36	108	30.6
Promedio	2,525	684	88	43	133	27.1

Fuente: Situación Económica: Hoja de Balance de Alimentos, Estadística Panameña, Contraloría General de la República, varios años, Panamá.

Apéndice 0.3. Precios corrientes a 1970 de los alimentos representados, e ingresos per cápita reales de Panamá, 1960-1985. (Moneda: US\$)

Año	Leche Pasteurizada (½ Galón)	Huevos ½ Doc.	Carne Res	Carne Pollo	Carne Cerdo	Yuca Fresca libra	Papa	Plátano	Maíz	Pan Trigo (18 Oz)	Arroz Primera libra	Ingresos Per- Capita Reales	Índice Precio Consumidor Alimento
1960	0.29	0.36	0.450	0.525	0.60	0.05	0.100	0.30	0.071	0.20	0.150	938.3	57.2
1961	0.29	0.36	0.450	0.540	0.60	0.05	0.099	0.30	0.087	0.20	0.150	1,011.5	57.5
1962	0.29	0.34	0.450	0.550	0.60	0.05	0.100	0.30	0.084	0.20	0.150	1,056.1	57.8
1963	0.29	0.31	0.450	0.547	0.60	0.05	0.096	0.30	0.096	0.20	0.158	1,107.1	58.1
1964	0.29	0.32	0.452	0.600	0.60	0.062	0.100	0.336	0.113	0.20	0.150	1,127.3	59.5
1965	0.29	0.34	0.483	0.600	0.60	0.05	0.100	0.313	0.104	0.20	0.150	1,190.8	59.8
1966	0.29	0.31	0.500	0.600	0.60	0.05	0.100	0.299	0.100	0.20	0.148	1,250.8	59.9
1967	0.29	0.32	0.525	0.600	0.607	0.05	0.100	0.296	0.104	0.20	0.140	1,316.3	60.7
1968	0.29	0.31	0.574	0.610	0.617	0.058	0.100	0.318	0.121	0.20	0.140	1,366.4	61.7
1969	0.29	0.34	0.600	0.600	0.629	0.05	0.101	0.307	0.110	0.20	0.140	1,439.1	62.9
1970	0.29	0.36	0.605	0.600	0.675	0.05	0.101	0.319	0.098	0.252	0.140	1,496.2	64.8
1971	0.29	0.384	0.606	0.612	0.756	0.05	0.10	0.336	0.110	0.252	0.140	1,571.9	66.4
1972	0.29	0.366	0.634	0.600	0.836	0.05	0.109	0.35	0.115	0.234	0.140	1,626.9	69.4
1973	0.29	0.384	0.753	0.640	0.89	0.05	0.115	0.365	0.163	0.306	0.150	1,677.8	76.2
1974	0.35	0.432	0.869	0.687	1.069	0.05	0.145	0.382	0.196	0.441	0.195	1,668.6	93.6
1975	0.35	0.39	0.888	0.718	1.175	0.068	0.160	0.475	0.157	0.486	0.215	1,619.2	100.0
1976	0.357	0.416	1.000	0.712	1.209	0.08	0.169		0.164	0.36	0.208	1,576.5	101.4
1977	0.37	0.427	1.000	0.712	1.224	0.08	0.186	0.60	0.175	0.329	0.230	1,601.8	104.4
1978	0.37	0.461	1.154	0.724	1.266	0.08	0.189	0.60	0.177	0.34	0.227	1,668.8	110.9
1979	0.37	0.464	1.471	0.727	1.327	0.08	0.186	0.60	0.184	0.34	0.220	1,747.1	122.2
1980	0.425	0.51	1.550	0.810	1.42	0.095	0.234	0.62	0.267	0.398	0.253	1,784.7	137.6
1981	0.45	0.56	1.550	0.920	1.51	0.11	0.250	0.62	0.380	0.43	0.320	1,811.6	150.2
1982	0.46	0.63	1.550	0.950	1.62	0.11	0.240	0.744	0.350	0.44	0.320	1,917.2	159.1
1983	0.52	0.63	1.550	0.960	1.83	0.14	0.270	0.744	0.350	0.44	0.320	1,878.8	162.8
1984	0.53	0.63	1.550	0.960	1.89	0.14	0.390	0.868	0.270	0.44	0.320	1,834.9	165.2
1985	0.53	0.63	1.550	0.960	1.95	0.12	0.350	1.24	0.337	0.44	0.320	1,851.7	165.7
Tasa de Crecimiento (%)	2.41	2.24	4.95	2.41	4.71	3.50	4.90	5.68	6.15	3.15	3.03	2.82	4.25

Fuente: PANAMA en Cifras, varios años, Contraloría General de la República, Panamá

Apéndice 3.4: Funciones de Demanda en el Consumo de Leche Pasteurizada en Panamá, para la Totalidad de su Población, 1960-1983.

Concepto	Constante	Precio Real Leche	Precio Real Yuca	Ingreso Real Per Capita	R ²	Forma Funcional
Parámetros	15.136	-30.315		0.007092	0.925	Lineal
Error Standard	1.286	9.196		0.002505		
Valor t	11.77	3.30		2.83		
Elasticidad		- 0.941 *		0.796 *		
Parámetros	-7.334	- 0.514		1.289	0.931	Doble Logarítmica
Error Standard	0.102	0.233		0.223		
Valor t	71.90	2.21		5.78		
Elasticidad		- 0.514 *		1.289 *		
Parámetros	13.027	-30.689	20.576	0.007533	0.926	Lineal
Error Standard	1.307	9.365	35.082	0.002654		
Valor t	9.97	3.28	0.587	2.84		
Elasticidad		- 0.953 *	0.122	0.845 *		
Parámetros	-7.375	- 0.525	0.120	1.336	0.932	Doble Logarítmica
Error Standard	0.104	0.238	0.210	0.241		
Valor t	70.91	2.21	0.575	5.54		
Elasticidad		- 0.525 *	0.120	1.336 *		

* : Significativo al 95%

Apéndice 3.5: Funciones de Demanda en el Consumo de Huevos en Panamá, para la Totalidad de su Población, 1960-1983.

Concepto	Constante	Precio Real Huevo	Precio Real Yuca	Ingreso Real Per Capita	R ²	Forma Funcional
Parámetros	0.160	- 2.775		0.004756	0.776	Lineal
Error Standard	0.866	3.801		0.001054		
Valor t	0.185	0.73		4.51		
Elasticidad		- 0.238		1.210 *		
Parámetros	-6.332	- 0.372		1.069	0.766	Doble
Error Standard	0.156	0.330		0.257		Logarítmica
Valor t	40.59	1.127		4.16		
Elasticidad		- 0.372		1.069 *		
Parámetros	1.162	- 2.985	- 7.088	0.004525	0.777	Lineal
Error Standard	0.886	3.952	24.125	0.001335		
Valor t	1.31	0.76	0.29	3.39		
Elasticidad		- 0.256	- 0.095	1.151 *		
Parámetros	-6.057	- 0.397	- 0.226	0.950	0.771	Doble
Error Standard	0.158	0.335	0.320	0.315		Logarítmica
Valor t	38.34	1.19	0.71	3.02 *		
Elasticidad		- 0.397	- 0.226	0.950		

* : Significativo al 95%

Apéndice 3.6: Funciones de Demanda en el Consumo de Carne de Res en Panamá, para la Totalidad de su Población, 1960-1983.

Concepto	Constante	Precio Real Carne de Res	Precio Real Yuca	Ingreso Real Per Capita	R ²	Forma Funcional
Parámetros	18.486	- 11.500		0.009068	0.707	Lineal
Error Standard	1.146	3.646		0.001447		
Valor t	16.13	3.15		6.27		
Elasticidad		- 0.497 *		0.630 *		
Parámetros	- 1.346	- 0.502		0.598	0.704	Doble Logarítmica
Error Standard	0.054	0.171		0.101		
Valor t	24.93	2.94		5.92		
Elasticidad		- 0.502 *		0.598 *		
Parámetros	12.397	- 10.569	48.627	0.0100	0.741	Lineal
Error Standard	1.104	3.559	29.971	0.002		
Valor t	11.23	2.97	1.62	6.62		
Elasticidad		- 0.457 *	0.178	0.697 *		
Parámetros	- 1.344	- 0.460	0.191	0.666	0.748	Doble Logarítmica
Error Standard	0.051	0.163	0.103	0.102		
Valor t	26.35	2.81	1.85	6.53		
Elasticidad		- 0.460 *	0.191 *	0.666 *		

* : Significativo al 95%

Apéndice 3.7: Funciones de Demanda en el Consumo de Carne de Pollo en Panamá, para la Totalidad de su Población, 1960-1983.

Concepto	Constante	Precio Real Carne de Pollo	Precio Real Yuca	Ingreso Real Per Capita	R ²	Forma Funcional
Parámetros	9.005	- 8.880		0.002844	0.763	Lineal
Error Standard	1.246	2.911		0.001624		
Valor t	7.23	3.05		1.75		
Elasticidad		- 1.233 *		0.711 *		
Parámetros	- 2.752	- 1.155		0.579	0.851	Doble
Error Standard	0.148	0.244		0.242		Logarítmica
Valor t	18.59	4.73		2.39		
Elasticidad		- 1.155 *		0.579 *		
Parámetros	1.416	- 9.404	71.768	0.004470	0.815	Lineal
Error Standard	1.128	2.646	30.322	0.001623		
Valor t	1.26	3.55	2.37	2.75		
Elasticidad		- 1.306 *	0.945 *	1.118 *		
Parámetros	- 2.955	- 1.184	0.447	0.762	0.867	Doble
Error Standard	0.143	0.237	0.288	0.263		Logarítmica
Valor t	20.66	5.00	1.55	2.90		
Elasticidad		- 1.184 *	0.447	0.762 *		

* : Significativo al 95%

Apéndice 3.8: Funciones de Demanda en el Consumo de Carne de Cerdo en Panamá, para la Totalidad de su Población, 1960-1983.

Concepto	Constante	Precio Real Carne de Cerdo	Precio Real Yuca	Ingreso Real Per Capita	R ²	Forma Funcional
Parámetros	7.101	- 5.425		0.000981	0.386	Lineal
Error Standard	0.490	1.562		0.000397		
Valor t	14.49	3.47		2.47		
Elasticidad		- 2.148 *		0.535 *		
Parámetros	- 1.445	- 1.950		0.352	0.330	Doble Logarítmica
Error Standard	0.175	0.611		0.198		
Valor t	8.26	3.19		1.78		
Elasticidad		- 1.950 *		0.352 *		
Parámetros	7.726	- 5.579	- 4.147	0.00089	0.388	Lineal
Error Standard	0.501	1.681	14.113	0.00051		
Valor t	15.42	3.32	0.29	1.75		
Elasticidad		- 2.209 *	- 0.119	0.485 *		
Parámetros	- 1.397	- 2.038	- 0.167	0.288	0.336	Doble Logarítmica
Error Standard	0.178	0.654	0.377	0.249		
Valor t	7.85	3.12	0.44	1.16		
Elasticidad		- 2.038 *	- 0.167	0.288 *		

* : Significativo al 95%

Apéndice 3.9: Funciones de Demanda en el Consumo de Yuca en Panamá, para la Totalidad de su Población, 1960-1983.

Concepto	Constante	Precio Real Yuca	Precio Real Ñame	Precio Real Papa	Ingreso Real Per Capita	R ²	Forma Funcional
Parámetros	25.431	-156.21			0.000838	0.344	Lineal
Error Standard	2.678	71.74			0.002704		
Valor t		2.18			0.31		
Elasticidad		- 0.843 *			0.086		
Parámetros	- 0.623	- 0.701			0.203	0.391	Doble
Error Standard	0.171	0.349			0.235		Logarítmica
Valor t	3.64	2.04			0.86		
Elasticidad		- 0.701 *			0.203		
Parámetros	44.139	- 71.390	- 54.084	- 129.901	0.004532	0.550	Lineal
Error Standard	2.332	68.873	21.785	72.498	0.003019		
Valor t	18.93	1.037	2.48	1.79	1.50		
Elasticidad		- 0.385	- 0.662 *	- 1.473 *	0.464		
Parámetros	- 5.495	- 0.335	- 0.680	- 1.195	0.540	0.596	Doble
Error Standard	0.146	0.320	0.245	0.750	0.253		Logarítmica
Valor t	37.64	1.05	2.78	1.59	2.13		
Elasticidad		- 0.335	- 0.680 *	- 1.195	0.540 *		

* : Significativo al 95%

Apéndice 4.1

PANAMA

Presupuesto Parcial: evaluación privada

Maíz: 1 ha

precios: US\$, julio, '86

Estos resultados provienen de promedios ponderados de presupuestos parciales de las provincias de Los Santos, Chiriquí y Herrera, las cuales en conjunto explicaban en 1980 un 69% del valor total comercializado del producto.

Ingresos Brutos

3,129 kgs/ha a \$230.00 = US\$719.68/ha

Gastos

A) Insumos

(a) Urea:	189.42 Kgs	a \$313.45/ton	= US\$ 59.37
(b) 15-30-8:	222.00 kg	a \$330.69/ton	= US\$ 73.41
(c) Semilla:	17.65 kgs	a \$ 2.00/kg	= US\$ 35.30
(d) Gesaprim:	2.5 kgs	a \$ 7.50/kg	= US\$ 18.75
(e) Prowl:	2.5 lt	a \$ 10.0 /lt	= US\$ 25.00
(f) Sacos:	70 sacos	a \$ 0.25/saco	= US\$ 17.50
(g) Hilo:	0.27 cono	a \$ 6.12/cono	= US\$ 1.65
(h) Seguro Agrícola:			= <u>US\$ 22.54</u>

Sub-Total US\$253.52

=====

B) Maquinaria

(a) Tractor:	90-110 HP, 3 horas	a \$22/h	= US\$ 66.00
(b) Tractor:	70-90 HP, 2 horas	a \$18/h	= US\$ 36.00
(c) Tractor:	60-70 HP, 2.5 horas	a \$17/h	= US\$ 42.50

(d) Desgranadora, 1 hora	a \$24.5/h =	US\$ 24.50
(e) Fumigadora, 8 horas	a \$0.35/h =	US\$ 2.80
	Sub-Total	US\$171.80
		=====

C) Transporte

(a) Insumos 440 kgs	a \$14.06/ton =	US\$ 6.19
(b) Producto: 3,129 kgs	a \$22.00/ton =	US\$68.84
	Sub-Total:	US\$75.03
		=====

D) Mano de Obra

(a) 96.6 horas	a 0.75/hora =	US\$75.45
(b) 8 horas	a 0.88/hora =	US\$ 7.04
(c) 5 horas	a 1.00/hora =	US\$ 5.00
	Sub-Total	US\$84.49
		=====

E) <u>Renta de Tierra</u>	US\$70.00

F) <u>Intereses Bancarios:</u> 9% sobre 75% costo total	
durante 6 meses	US\$22.10

G) <u>Imprevistos:</u> 5% sobre costo total	US\$33.85

----- 0 -----

Resumen de Costos.Totales

(a) Insumos:	US\$253.52	(35.7%)
(b) Maquinaria:	US\$171.80	(24.2%)
(c) Transporte:	US\$ 75.03	(10.6%)

(d) Mano de Obra:	US\$ 84.49	(11.9%)
(e) Renta de Tierra:	US\$ 70.00	(9.8%)
(f) Intereses Bancarios:	US\$ 22.10	(3.1%)
(g) Imprevistos:	<u>US\$ 33.85</u>	(4.8%)
T o t a l:	US\$710.79	

Beneficio Neto Privado

Ingreso Brutos:	US\$719.68
Costos Totales:	<u>US\$710.79</u>
Beneficio Neto:	US\$ 8.89

Relación Insumo/Producto

$$\frac{710.79}{719.68} = 0.988$$

Remuneración a la Administración:

$$\frac{8.89}{710.79} = 1.25\%$$

Rendimiento Mínimo para Cubrir Costos Totales:

$$\frac{\$710.79}{\$230.00} = 3,090 \text{ kgs/ha}$$

Apéndice 4.2

PANAMA

Presupuesto Parcial: evaluación privada

Sorgo Granífero: 1 ha

precios, US\$, julio, '86

Estos resultados provienen de promedios ponderados de presupuestos parciales de las provincias de Los Santos, Chiriquí y Herrera, las cuales en conjunto explicaban en 1980 un 82% del valor total comercializado del producto.

Ingresos Brutos

3,363 kgs/ha a \$206.35/ton = US\$693.96/ha

Gastos

A) Insumos

(a) Urea:	136.94 Kgs	a \$317.00 /ton	= US\$ 43.41
(b) 15-30-08:	169.46 kg	a \$330.69 /ton	= US\$ 56.04
(c) Semilla:	13.6 kgs	a \$ 1.782/kg	= US\$ 24.20
(d) Gesaprim:	2.5 kgs	a \$ 6.00 /kg	= US\$ 15.00
(e) Nubacrom:	2.0 1t	a \$ 10.7 /1t	= US\$ 81.40
(f) Bolsas:	75	a \$ 0.26 /c/u	= US\$ 19.50
(g) Hilo:	0.3 cono	a \$ 5.8 /cono	= US\$ 1.74
(h) Seguro Agrícola:			= <u>US\$ 28.24</u>

Sub-Total US\$209.53

=====

B) Maquinaria

(a) Tractor:	70-80 HP, 3 horas	a \$18/h	= US\$ 54.00
(b) Tractor:	70-80 HP, 1 hora	a \$20/h	= US\$ 20.00
(c) Tractor:	70-80 HP, 2 horas	a \$22/h	= US\$ 44.00

(d) Tractor:	60-70 HP, 1 hora	a \$16.5/h = US\$ 16.50
(e) Avión		= US\$ 18.43
(f) Cosechadora,	1 hora	a \$60/h = US\$ 60.00
(g) Fumigadora,	16 horas	a \$0.35/h = <u>US\$ 5.60</u>
	Sub-Total	US\$218.53
		=====

C) Transporte

(a) de insumos:	320 kgs a \$15.43/ton = US\$ 4.94
(b) de producto:	3,363 kgs a \$22.00/ton = <u>US\$74.00</u>
	Sub-Total: US\$78.94
	=====

D) Mano de Obra

38 horas/ha a \$0.625/hora = US\$23.78

E) Renta de Tierra US\$70.00

F) Intereses Bancarios: 9% sobre 75% costo total
durente 6 meses US\$20.28

G) Imprevistos: 5% sobre costo total US\$31.05

Resumen de Costos Totales

(a) Insumos:	US\$209.53	(32.1%)
(b) Maquinaria:	US\$218.53	(33.5%)
(c) Transporte:	US\$ 78.94	(12.1%)
(d) Mano de Obra:	US\$ 23.78	(3.6%)
(e) Renta de Tierra:	US\$ 70.00	(10.7%)
(f) Intereses:	US\$ 20.28	(3.1%)
(g) Imprevistos:	<u>US\$ 31.05</u>	(4.8%)
T o t a l:	US\$652.11	

Beneficio Neto Privado

Ingreso Brutos:	US\$693.96
Costos Totales:	<u>US\$652.10</u>
Beneficio Neto:	US\$ 41.86

Relación Insumo/Producto

$$\frac{652.10}{693.96} = 0.940$$

Remuneración a la Administración:

$$\frac{\text{Beneficio Neto}}{\text{Costos Totales}} = \frac{41.86}{652.10} = 6.4\%$$

Rendimiento Mínimo para Cubrir Costos Totales:

$$\frac{652.10}{206.00} = 3,160 \text{ kgs/ha}$$

Apéndice 4.3

PANAMA

Presupuesto Parcial: evaluación privada

Yuca: 1 ha

precios: US\$, julio, '86

Ubicación: Provincia de Herrera

Ingresos Brutos

15 ton a \$45.70 = US\$685.50/ha

Gastos

A) Insumos

(a) 12-24-12:	45.36	a \$330.69 /ton	= US\$ 43.41
(b) Malathión:	0.4 lt	a \$ 3.50 /lt	= US\$ 1.40
(c) Tithane:	1.0 kg	a \$ 4.7 /lt	= US\$ 4.70
(d) Mirex:	1.36 kg	a \$ 5.51 /kg	= US\$ 7.50
(e) Gramoxone:	2 lt	a \$ 5.00 /lt	= US\$ 10.00
(f) Diurón	2.5 kg	a \$ 10.00 /kg	= US\$ 25.00
(g) Bolsas:	75	a \$ 0.20 /c/u	= <u>US\$ 15.00</u>
		Sub-Total	<u>US\$ 78.60</u>

=====

B) Maquinaria

(a) Tractor:	60-70 HP, 6 horas	a \$17.0/h	= US\$102.00
(b) Fumigadora,	16 horas	a \$0.35/h	= <u>US\$ 5.60</u>
		Sub-Total	<u>US\$107.60</u>

=====

C) Transporte

(a) de insumos: 90 kgs a \$11.02/ton = US\$ 0.99

(b) de producto: 15.0 ton a \$ 2.15/ton = US\$32.25

Sub-Total: US\$33.24

=====

D) Mano de Obra

50 jornales a \$5/jornal = US\$250.00

E) Renta de Tierra US\$70.00

F) Intereses Bancarios: 9% sobre 66% costo
total durante 1 año = US\$32.04

G) Imprevistos: 5% sobre costo total = US\$28.57

Resumen de Costos Totales

(a) Insumos:	US\$ 78.60	(13.1%)
(b) Maquinaria:	US\$107.60	(17.9%)
(c) Transporte:	US\$ 33.24	(5.5%)
(d) Mano de Obra:	US\$250.00	(41.7%)
(e) Renta de Tierra:	US\$ 70.00	(11.7%)
(f) Intereses:	US\$ 32.04	(5.3%)
(g) Imprevistos:	<u>US\$ 28.57</u>	<u>(4.8%)</u>
T o t a l:	US\$600.05	(100.0%)

Beneficio Neto Privado

Ingreso Brutos:	US\$685.50
Costos Totales:	<u>US\$600.05</u>
Beneficio Neto:	US\$ 85.45

Relación Insumo/Producto

$$\frac{600.05}{685.50} = 0.875$$

Remuneración a la Administración:

$$\frac{\text{Beneficio Neto}}{\text{Costos Totales}} = \frac{85.45}{600.05} = 14.2\%$$

Rendimiento Mínimo para Cubrir Costos Totales:

$$\frac{600.05}{45.7} = 13,130 \text{ kgs/ha}$$

Apéndice 4.4: Estimación de Costos Privados para el Secamiento Natural de Yuca en Patios de Concreto de 500 m², en Herrera, Panamá (julio, 1986).

Supuestos Iniciales:

Dichos patios de 500 m² tendrán la capacidad de procesar 287.4 tons de yuca fresca durante 16 semanas. Ello implica que podrá secar tres tandas semanales a razón de 12 kgs/m² de carga. El factor de conversión de yuca fresca a seca se estableció en 2.51/1.00. Consecuentemente la producción de yuca seca en este patio será de 114.50 tons.

Componentes de Costos

A) Costos Fijos

(a) Patio con Bodega

Costo Inicial	US\$5,750
Valor Residual	10%
Vida Util	15 años
Depreciación Anual	US\$ 345
Depreciación/ton yuca seca producida	US\$3.01/ton

(b) Máquina Picadora

Costo Inicial	US\$1,000
Valor Residual	10%
Vida Util	8 años
Depreciación Anual	US\$112.50
Depreciación/ton yuca seca	US\$0.98/ton

(c) Motor Picadora (5 HP)

Costo Inicial	US\$400.00
Valor Residual	5%
Vida Util	3 años
Depreciación Anual	US\$126.67
Depreciación/ton seca	US\$1.11/ton

(d) Báscula (500 kgs)

Costo Inicial	US\$810
Valor Residual	10%
Vida Util	8 años
Depreciación Anual	US\$91.13
Depreciación/ton seca producida	US\$0.80/ton

(e) Materiales y Equipos

250 m ² plástico	US\$356.00
(2) Carretillas	US\$ 90.00
(4) Rastrillos +	
(2) Recogedores +	
(2) Palas Metálicas	US\$140.00
200 Sacos nylon	<u>US\$100.00</u>
T o t a l:	US\$686.00

Valor Residual	0.0%
Vida Util	2 años
Depreciación Anual	US\$343.00
Depreciación/ton seca producida	US\$3.00/ton

(f) Costo Anual de Oportunidad

Sobre las inversiones iniciales	
totales de US\$8,646, a un 10%	
interés anual	US\$7.55/ton

Resumen de Costos Fijos

	US/ton Seca	% Costo Total
(a) Depreciación de patio y bodega	3.01	1.8
(b) Depreciación de picadora	0.98	0.6
(c) Depreciación de motor de picadora	1.11	0.7
(d) Depreciación de báscula	0.80	0.5
(e) Depreciación de materiales y equipos	3.00	1.8
(f) Costos de Oportunidad de Inversiones	7.55	4.4

B) Costos Variables

- (a) Materia Prima (US\$45.70/ton fresca)
Transformada a yuca seca por el
factor 2.51 US\$114.71
- (b) Reparación y Mantenimiento de Picadora
y su motor (16% del costo inicial),
llevado a ton seca US\$ 1.96
- (c) Combustibles y Lubricantes
1.0 lt/ton fresca a US\$0.61/lt
más aceite (10% del combustible),
llevado a ton seca US\$ 1.68
- (d) Mano de Obra
8 horas hombre/ton fresca a razón
de US\$0.625/hora US\$ 12.55
- (e) Intereses Bancarios
al 9% sobre un 80% costos variables
(US\$104.72) durante un mes US\$ 0.79

Resumen de Costos Variables

	<u>US\$/ton Seca</u>	<u>% Costo</u>
		<u>Total</u>
(a) Materia Prima	US\$114.71	67.4
(b) Rep. y Mant. Picadora y Motor	US\$ 1.96	1.2
(c) Combustibles y Lubricantes	US\$ 1.68	1.0
(d) Mano de Obra	US\$ 12.55	7.4
(e) Intereses Bancarios	US\$ 0.79	0.5
Sub-Total	US\$131.69	
(f) Transporte del producto seco del patio al centro de consumo en Panamá	US\$ 22.00	12.9
Total:	US\$153.69	

<u>Costos Totales</u>	<u>US\$/ton Seca</u>	<u>%</u>
Costos Fijos	US\$ 16.45	9.7
Costos Variables	<u>US\$153.69</u>	<u>90.3</u>
Total:	US\$170.14	100.0

Apéndice 4.5

PANAMA

Presupuesto Parcial: evaluación social

Maíz: 1 ha

precios: US\$, julio, '86

Ingresos Brutos

3,129 kgs/ha a \$115.92 = US\$362.71/ha

Gastos

A) Insumos

(a) Urea:	189.42 Kgs	a \$125.7 /ton	= US\$ 23.81
(b) 15-30-8:	222.00 kg	a \$170.2 /ton	= US\$ 37.78
(c) Semilla:	17.65 kgs	a \$1.504 /kg	= US\$ 26.55
(d) Gesaprim:	2.5 kgs	a \$ 5.07/kg	= US\$ 12.68
(e) Prowl:	2.5 lt	a \$ 6.76 /lt	= US\$ 16.90
(f) Sacos:	70 sacos	a \$ 0.25/saco	= US\$ 17.50
(g) Hilo:	0.27 cono	a \$ 6.12/cono	= US\$ 1.65
(h) Seguro Agrícola:			= <u>US\$ 22.54</u>
		Sub-Total	US\$159.41

=====

B) Maquinaria

(a) Tractor:	90-110 HP, 3 horas	a \$11.98	= US\$ 35.94
(b) Tractor:	70-90 HP, 2 horas	a \$ 9.80	= US\$ 19.60
(c) Tractor:	60-70 HP, 2.5 horas	a \$ 9.26	= US\$ 23.15
(d) Desgranadora,	1 hora	a \$24.5/h	= US\$ 24.50
(e) Fumigadora,	8 horas	a \$0.35/h	= <u>US\$ 2.80</u>
		Sub-Total	US\$105.99

=====

C) Transporte

(a) Insumos 440 kgs a \$ 8.86/ton = US\$ 3.90

(b) Producto: 3,129 kgs a \$13.86/ton = US\$43.37

Sub-Total: US\$47.27

=====

D) Mano de Obra

110 horas a \$0.54 = US\$ 59.40

E) Renta de Tierra US\$ 0.00

F) Intereses Bancarios: 7% sobre 75%_costo total
durante 6 meses US\$ 9.77

G) Imprevistos: 5% sobre costo total US\$ 19.09

Costo Total US\$400.93

Resumen de Costos Sociales Totales

(a) Insumos:	US\$159.41	(39.8%)
(b) Maquinaria:	US\$105.99	(26.4%)
(c) Transporte:	US\$ 47.27	(11.8%)
(d) Mano de Obra:	US\$ 59.40	(14.8%)
(e) Renta de Tierra:	US\$ 0.00	(0.0%)
(f) Intereses Bancarios:	US\$ 9.77	(2.4%)
(g) Imprevistos:	<u>US\$ 29.09</u>	(4.8%)
T o t a l:	US\$400.93	

Beneficio Neto Social

Ingreso Brutos:	US\$362.71
Costos Totales:	<u>US\$400.93</u>
Beneficio Neto:	-US\$ 38.22

Rendimiento Mínimo para Cubrir Costos Totales:

$$\frac{\$400.93}{\$115.92} = 3,459 \text{ kgs/ha}$$

Precio Mínimo para Remuneración a la Administración al 10% sobre Costos Totales y Rendimientos Presentes

$$\frac{400.93 \cdot 1.10}{3,129} = \text{US\$140.95/ton}$$

Apéndice 4.6

PANAMA

Presupuesto Parcial: evaluación Social

Sorgo Granífero: 1 ha

precios, US\$, julio, '86

Ingresos Brutos

3,363 kgs/ha a \$107.07/ton = US\$360.08

Gastos

A) Insumos

(a) Urea:	136.94 Kgs	a \$125.7 /ton	= US\$ 17.21
(b) 15-30-08:	169.46 kg	a \$170.2 /ton	= US\$ 28.84
(c) Semilla:	13.6 kgs	a \$. 1.353/kg	= US\$ 18.40
(d) Gesaprim:	2.5 kgs	a \$ 5.07 /kg	= US\$ 12.68
(e) Nubacrom:	2.0 lt	a \$ 9.04 /lt	= US\$ 18.08
(f) Bolsas:	75	a \$ 0.26 /c/u	= US\$ 19.50
(g) Hilo:	0.3 cono	a \$ 5.8 /cono	= US\$ 1.74
(h) Seguro Agrícola:			= <u>US\$ 28.24</u>
		Sub-Total	US\$144.69
			=====

B) Maquinaria

(a) Tractor:	70-80 HP, 3 horas	a \$ 9.80	= US\$ 29.40
(b) Tractor:	70-80 HP, 1 hora	a \$10.89	= US\$ 10.89
(c) Tractor:	70-80 HP, 2 horas	a \$11.98	= US\$ 23.96
(d) Tractor:	60-70 HP, 1 hora	a \$ 8.89	= US\$ 8.98
(e) Avión			= US\$ 10.04
(f) Cosechadora,			= US\$ 42.81
(g) Fumigadora,	16 horas	a \$0.35/h	= <u>US\$ 5.60</u>
		Sub-Total	US\$131.68
			=====

C) Transporte

(a) de insumos:	320 kgs a \$ 9.72/t	= US\$ 3.11
(b) de producto:	3,363 kgs a \$13.86/t	= <u>US\$46.61</u>
		US\$49.72
		=====

D) Mano de Obra

38 horas/ha a \$0.438/hora = US\$ 16.64

E) Renta de Tierra US\$ 0.00

F) Intereses Bancarios: 7% sobre 75% costo total
durante 6 meses US\$ 9.00

G) Imprevistos: 5% sobre costo total US\$ 17.59
Costo Total US\$369.32

Resumen de Costos Totales

(a) Insumos:	US\$144.69	(39.2%)
(b) Maquinaria:	US\$131.68	(35.7%)
(c) Transporte:	US\$ 49.72	(13.5%)
(d) Mano de Obra:	US\$ 16.64	(4.5%)
(e) Renta de Tierra:	US\$ 0.00	(0.0%)
(f) Intereses:	US\$ 9.00	(2.4%)
(g) Imprevistos:	<u>US\$ 17.59</u>	(4.8%)
T o t a l:	US\$369.32	

Beneficio Neto Social

Ingreso Brutos:	US\$360.08
Costos Totales:	<u>US\$369.32</u>
Beneficio Neto:	-US\$ 9.24

Apéndice 4.7

PANAMA

Presupuesto Parcial: evaluación social

Yuca: 1 ha

precios: US\$, julio, '86

Ingresos Brutos

15 ton a \$22.33 = US\$334.95

Gastos

A) Insumos

(a) 12-24-12:	45.36 kgs	a \$170.20/t	= US\$ 7.72
(b) Malathión:	0.4 lt	a \$ 2.96	= US\$ 1.18
(c) Tithane:	1.0 kg	a \$ 3.97	= US\$ 3.97
(d) Mirex:	1.36 kg	a \$ 4.66	= US\$ 6.34
(e) Gramoxone:	2 lt	a \$ 4.23	= US\$ 8.46
(f) Diurón	2.5 kg	a \$ 8.45	= US\$21.13
(g) Bolsas:	75	a \$ 0.20 c/u	= <u>US\$15.00</u>
		Sub-Total	US\$63.80
			=====

B) Maquinaria

(a) Tractor:	60-70 HP, 6 horas	a \$9.26/h	= US\$55.56
(b) Fumigadora,	16 horas	a \$0.35/h	= <u>US\$ 5.60</u>
		Sub-Total	US\$61.16
			=====

C) Transporte

(a) de insumos:	90 kgs	a \$6.94/ton	= US\$ 0.62
(b) de producto:	15 ton	a \$1.35/ton	= <u>US\$20.25</u>
		Sub-Total:	US\$20.87
			=====

Rendimiento Mínimo para Cubrir Costos Totales:

$$\frac{\$369.71}{\$107.07} = 3,449 \text{ kgs/ha}$$

Precio Mínimo para Remunerar a la Administración al 10% sobre Costos Totales y Rendimientos Presentes:

$$\frac{369.71 \cdot 1.10}{3,363} = \text{US\$120.80/ton}$$

Apéndice 5.1: Coeficientes Técnicos y Económicos de la Totalidad de los Ingredientes Considerados en la Elaboración de Raciones Balanceadas.

Concepto	H. Gluten										
	Maíz	Yuca	Sorgo	Acemite	Pescado	Soya	Maíz	Caliza	Dical	Lisina	Metionina
Precio Unitario (US\$/ton)	251.32	176.37	229.28	154.32	396.83	310.85	337.30	55.12	388.01	2,771.18	2,594.81
Energía Metabolizable (Mcal/kg)	3.37	3.20	3.20	1.96	2.74	2.43	3.86			4.41	4.41
Proteína (%)	8.50	1.00	9.00	15.00	54.00	48.00	64.00			72.0	62.0
Grasa (%)	4.50	0.30	3.50	3.60	6.50	0.50	2.00				
Calcio (%)	0.02	0.15	0.03	0.15	7.50	0.20	0.02	37.0	30.0		
Fósforo Total (%)	0.29	0.08	0.28	0.91	3.00	0.65	0.70		18.0		
Fósforo Digestible (%)	0.09	0.02	0.08	0.27	3.00	0.19	0.20		18.0		
Metionina (%)	0.18	0.05	0.11	0.12	1.40	0.75	1.90				98.0
Metionina + Cistina (%)	0.32	0.20	0.29	0.31	2.20	1.49	3.00				98.0
Lisina (%)	0.20	0.05	0.27	0.60	4.20	3.20	1.00			78.0	1.0
Arginina (%)	0.52	0.40	0.40	1.00	2.40	3.80	1.90				
Treonina (%)	0.34	0.23	0.27	0.50	2.15	2.00	2.00				
Valina (%)	0.42	0.33	0.53	0.80	3.06	2.70	2.70				
Leucina (%)	1.00	0.37	1.40	1.10	3.40	3.80	9.40				
Isoleucina (%)	0.37	0.24	0.60	0.70	3.20	2.60	2.30				
Fenilalanina (%)	0.44	0.26	0.45	0.50	4.05	2.70	3.80				
Triptófano (%)	0.09	0.01	0.09	0.20	0.60	0.75	0.30				
Fibra	3.00	7.60	3.20	7.00	1.70	3.00	2.50				

Fuente: Comunicaciones Personales con Representantes de la Industria de Balanceados de Panamá.

D) Mano de Obra

50 jornales a \$3.50/jornal US\$175.00

E) Renta de la Tierra US\$ 0.00

F) Intereses Bancarios: 7% sobre 66% del
costo total durante
1 año = US\$ 14.82

G) Imprevistos: 5% sobre costo total = US\$ 16.78

Resumen de Costos Sociales Totales

(a) Insumos:	US\$ 63.80	(18.1%)
(b) Maquinaria:	US\$ 61.16	(17.4%)
(c) Transporte:	US\$ 20.87	(5.9%)
(d) Mano de Obra:	US\$175.00	(49.7%)
(e) Renta Tierra:	US\$ 0.00	(0.0%)
(f) Intereses Bancarios:	US\$ 14.82	(4.2%)
(g) Imprevistos:	<u>US\$ 16.78</u>	<u>(4.8%)</u>
T o t a l:	US\$352.43	

Beneficio Neto Privado

Ingreso Brutos:	US\$334.95
Costos Totales:	<u>US\$352.43</u>
Beneficio Neto:	-US\$ 17.48

Rendimiento Mínimo para Cubrir Costos Totales

$\frac{352.43}{22.33} = 15,783 \text{ kgs/ha}$

Apéndice 5.2: Niveles de Requerimientos a ser Satisfechos para Dietas de Pollos de Engorda y Aves Ponedoras Según Estado Productivo, en 100 kgs de Alimento Balanceado.

<u>Concepto</u>	<u>P O L L O S D E E N G O R D A</u>			<u>A V E S P O N E D O R A S</u>		
	<u>Iniciación</u>	<u>Crecimiento</u>	<u>Finalización</u>	<u>Iniciación</u>	<u>Crecimiento</u>	<u>Postura</u>
(a) Energía Metabolizable (Mcal/kg)	315	320	325	280	280	275
(b) Proteína (%)	23	20	18	20	15	16
(c) Calcio (%)	0.9 - 1.0	0.9 - 1.0	0.9 - 1.0	1.0	0.9	3.5-4.0
(d) Fósforo Total (%)	0.65	0.65	0.65	0.80	0.75	0.65
(e) Fósforo Digestible (%)	0.4 - 0.5	0.4 - 0.5	0.4 - 0.5	0.50	0.45	0.42
(f) Metionina (%)	0.52	0.47	0.44	0.40	0.30	0.36
(g) Metionina + Cistina (%)	0.88	0.80	0.74	0.70	0.52	0.60
(h) Lisina (%)	1.12	1.06	0.95	1.00	0.60	0.86
(i) Triptófano (%)	0.26	0.21	0.20	0.20	0.17	0.21
(j) Arginina (%)	1.30	1.14	1.04	1.20	0.80	1.10
(k) Treonina (%)	0.88	0.77	0.70	0.60	0.50	0.66
(l) Valina (%)	1.03	0.90	0.84	0.80	0.60	0.82
(m) Leucina (%)	1.70	1.50	1.36	1.40	1.15	1.50
(n) Isoleucina (%)	0.92	0.85	0.78	0.90	0.66	0.78
(o) Fenilalanina (%)	0.85	0.72	0.67	0.70	0.66	0.80
(p) Fibra				3.5 - 4.0	4.0 - 5.0	3.0-4.0
P O N D E R A C I O N (%)	0.247	0.323	0.430	0.0408	0.0972	0.862

Fuente: Hubbard Farms, Investigación y Desarrollo, New Hampshire, USA

Apéndice 5.3: Comportamiento de Ingredientes y Costos de Raciones Balanceadas de Mínimo Costo. Solución
 Cuando la Yuca es una Opción (100 kgs de Alimento Balanceado).

	DIETA DE POLLOS			DIETA DE PONEDORAS		
	Iniciación	Crecimiento	Finalización	Iniciación	Crecimiento	Postura
Costo (US\$/ton)	270.24	268.95	270.51	238.68	216.80	229.54
MAIZ	4.873	47.845	42.576	0.000	0.000	0.000
HARINA YUCA	20.000	20.000	20.000	24.385	43.508	29.040
SORGO	33.413	3.694	7.313	32.376	20.283	32.363
ACEMITE	0.000	0.241	0.000	7.599	5.851	0.000
HARINA PESCADO	12.381	12.535	12.609	17.611	0.000	4.574
SOYA	13.658	8.754	5.649	3.597	15.262	17.687
GLUTEN MAIZ 60	15.608	6.757	11.694	6.859	7.076	5.957
CALIZA	0.000	0.000	0.000	7.171	5.377	8.824
DICAL	0.000	0.000	0.000	0.402	2.642	1.553
LISINA	0.068	0.175	0.160	0.000	0.000	0.000
METIONINA	0.000	0.000	0.000	0.000	0.000	0.000
=====						

Composición Química

Proteína (%)	26.9	20.06	21.7	20.0	15.05	17.98
Energía (Mcal)	315.0	320.0	325.0	280.0	280.0	275.0
Grasa (%)	2.63	3.34	3.31	2.78	1.27	1.72
Fibra (%)	n/c	n/c	n/c	4.0	5.00	4.00

Apéndice 5.4: Comportamiento de Ingredientes y Costos de Raciones Balanceadas de Mínimo Costo. Soluciones Óptimas Cuando Yuca no es una Opción (100 kgs de Alimentos Balanceados).

	DIETA DE POLLOS			DIETA DE PONEDORAS		
	Iniciación	Crecimiento	Finalización	Iniciación	Crecimiento	Postura
Costo (US\$/ton)	277.93	278.49	278.68	244.00	226.28	232.69
MAIZ	38.488	55.582	70.734	0.000	0.000	0.000
HARINA YUCA	-	-	-	-	-	-
SORGO	27.308	16.436	4.970	50.576	53.036	52.837
ACEMITE	0.000	0.000	0.000	21.965	31.304	25.394
HARINA PESCADO	11.372	11.756	11.588	7.902	6.404	4.223
SOYA	14.958	10.354	7.091	12.492	0.000	12.097
GLUTEN MAIZ 60	7.857	5.770	5.514	5.983	8.130	3.877
CALIZA	0.000	0.000	0.000	0.126	0.249	0.680
DICAL	0.000	0.000	0.000	0.955	0.876	0.843
LISINA	0.017	0.102	0.105	0.000	0.000	0.000
METIONINA	0.000	0.000	0.000	0.000	0.000	0.049

Composición Química

Proteína (%)	24.1	21.3	19.7	22.2	18.4	19.4
Energía (Mcal)	315.0	320.0	325.0	280.0	280.0	275 275.0
Grasa (%)	3.66	4.01	4.26	3.26	3.56	3.18
Fibra (%)	n/c	n/c	n/c	3.81	4.20	4.00

The Cassava Economy of Latin America:
A Food Staple in Transition

I. Cassava in a Changing Economic Environment

1. Introduction: the information gap and the price of negligence
2. History of the crop
3. The changing nature of the agricultural sector in Latin America
4. Government interventions and patterns of growth in food production and consumption
5. Cassava trends: maintenance of a traditional role
6. Cassava in a development context: a commodity as a policy instrument

II. Cassava in a Development Policy Context

1. Structural change: planning under stress
2. Agrarian dualism: growth and resource use within a skewed land distribution
3. Poverty, urban food consumption, and policy response
4. The debt crises: the loss of degrees of freedom
5. Socio-economic policy objectives and the role of cassava

III. Evolution in Cassava Consumption: Staple or Vegetable

1. Cassava as chameleon: the diversity in consumption forms
2. Patterns of cassava consumption in Latin America
3. Cassava consumption over time
4. The inferior good debate: in search of an elasticity
 - a. Consumer preferences and consumption form
 - b. Consumption by income strata
 - c. Elasticity estimates
5. Urbanization and consumption: the price paid to marketing
6. Cassava and the political economy of the urban staple

IV. Cassava Production: The Complexity of a Simple System

1. Plant characteristics: the foundations of a cropping system
2. Agro-climatic distribution in Latin America: cassava is not grown where it grows best
3. The crop within a farming system: cassava as a small farm crop
4. The key to diversity: the varietal component
5. Management of the cassava cropping system: how important is yield
6. The determinants of yield: in search of improved technologies

7. The economics of cassava production
 - a. Labor and input use
 - b. Competition with other crops
 - c. The economics of the scale of production
 - d. The bottom line: the costs of production
8. The responsiveness of traditional systems
 - a. Intensification
 - b. New production technologies

V. Marketing: The Vital Link

1. The structure of traditional cassava markets
 - a. The fresh root market: the price of perishability
 - b. The farinha market
2. Price formation in cassava markets: the changing nature of wholesale markets
3. Market integration
4. Marketing and management of demand
5. Market risk and farmer response
6. Price illusion: the failure of the hidden hand
7. The engine of transition: the development of alternative markets

VI. Carbohydrate Diversity in the Urban Diet: Storage and the Tropical Potato

1. Fresh cassava and potato consumption in urban Latin America
2. Consumer characterization of fresh cassava
3. Creating the tropical potato: a fresh cassava storage technology
4. Consumer evaluations of stored cassava
5. The potential impact of cassava storage technology
6. Prospects in key countries for urban consumption of fresh cassava

VII. Cassava and the Political Economy of Wheat

1. Trends in wheat consumption and imports in Latin America
2. Food price subsidies for the urban poor: why wheat ?
3. The impact of wheat subsidies on cassava consumption: the Brazilian case
4. The evolution of wheat consumption: bread versus pasta
5. Composite flour: how to turn a good idea into costly follies
6. Appropriate design of a composite flour system
7. Composite flour and the shadow price of foreign exchange

VIII. The Meat of the Matter: Beef Substitution and the Derived Demand for Carbohydrate Sources

1. Meat as a wage good: the legacy of a land surplus economy
2. The recent revolution in meat consumption patterns: the supply response of chicken versus beef
3. The intensive frontier: substituting grass with feed concentrates
4. The great divide: sorghum versus maize in meeting feedgrain demand
5. Policy response to the rising import gap
6. The debt crisis and the cassava option
 - a. Cassava for animal feed concentrates
 - b. On-farm feeding of cassava
7. Dried cassava and grain price policy: is cassava price competitive
8. The potential impact of developing a dried cassava industry

IX. Starch: Cassava versus the Corn Products Corporation

1. The nature of starch demand: one market or a thousand markets
2. Cassava versus maize starch: the role of speciality markets
3. The diversity in the scale of cassava starch production: an issue ?
4. The location of cassava starch production: the importance of water
5. A difficult prognosis in a difficult market

X. Cassava Putty: Tailoring a Cassava Strategy to Different Needs

1. Haiti
2. Mexico
3. Paraguay
4. Brazil
5. Colombia
6. The malleability of cassava in a changing economic environment

XI. Cassava and the lazy-faire paradigm: the price is right or the creation of a vested interest

1. Linking policy objectives to cassava development
2. Can cassava compete ?
3. The implementation hurdle: the role of integrated cassava projects
4. The income potential of cassava in the development of the small farm sector
5. The Colombian case: turning hypothesis into reality
6. Defining the economic niche for cassava
7. Making the transition: the price of negligence and the promise of vested interests in cassava

VENEZUELA: POTENTIAL DEMAND FOR CASSAVA.-

I.- Macroeconomic Policy and Agriculture.

To better understand the agricultural development of Venezuela, we will briefly review the general evolvement of its economy and the set of global policies that shaped it, to later concentrate in the set of specific policies that affect the agricultural sector.

A.- Economic Policy Context.- By 1985 Venezuela had a population of 17.4 million people, (81.3% urban) a per capita GDP (in \$1984 dollars) of \$2,451, international reserves for US\$12.5 billion, a total disbursed external debt of US\$30 billion, exports of goods and services for US\$14.3 billion and imports for US\$6.7 billion for a positive balance in current account of US\$7.6 billion (Table 1).

Greatly increased oil revenues catapulted the country in the 1970's from the status of a developing country into the ranks of a middle-income nation. Oil constitutes the basis of the economy with about 75% of Government revenues and over 90% of export earnings.

Recent growth of the Venezuelan economy can be divided in three periods: 1958 to 1973, 1973 to 1978 and 1978 to present. The first period starts with the installation of the democratic regime of Romulo Betancourt. The new policy of import substitution was formulated, following Prebisch's theories on the subject. Real GDP grew at an annual 5.5% during the 1958-73 period while agriculture had a similarly strong growth of 4.3%. The livestock sector was specially dynamic at 6.6% per year while crops grew at 2.7% annually (Table 2).

In 1973, oil prices boomed and the economy accelerated its pace with real GDP growing at 6.3% per year in 1973-78. The livestock sector continued its remarkable expansion at 7.3% while crops grew at 5.0% (Table 2).

After 1978 the country entered a recession that was characterized by a sharp fall in oil export income, combined with an inability to continue borrowing abroad, an expanded foreign debt burden, an overvalued currency and massive capital flight. A financial and foreign exchange crisis broke in early 1983. Foreign reserves went from US\$ 19 billion in 1981 to less than US\$ 7 billion in 1983. Exchange controls, devaluation, and austerity brought the country's external accounts into balance.

In 1978-85, real GDP decreased at an annual rate of -1.5% while agriculture as a whole grew at 1.7% per year. The crop value of production had no significant trend (0.3% annually) while livestock continued to outpace most of the activities at

3.1% per year (Table 2).

B.-The Policy Environment.- Agriculture in Venezuela has been affected by what is known as the Dutch Disease. The large influx of foreign exchange resulting from a spectacular rise in oil prices (from around US\$5.00 per barrel in 1972 to near US\$40 in 1979) brought about a spending effect which raised the demand for both tradeables and nontradeables and increased the prices of the latter with the consequent appreciation in the exchange rate (Valdes, p. 170). In addition, resources have been sucked into the booming sector, moving labor from agriculture to the services and government sectors. Urbanization took place at an accelerated pace since the 1,930's (table 3). At the same time a rising demand for food products emerges.

Under those circumstances, Government actions to redirect resource allocation become crucial to stimulate growth in the non-oil sectors of the economy and particularly in agriculture, which is directly affected by the rural-urban migration associated with the process.

The major policy tools devised by the Government have to do with administration of oil related activities. Extractive industries have been nationalized. A special fund (Venezuelan Investment Fund) was created primarily for investment abroad in order to avoid internal fluctuations related with changing conditions in the oil market, and as a regulatory fund.

To compensate for the disequilibriums brought about by the oil sector, the Government has operated a vast set of complementary tools ranging from exchange rate policy, to price controls, fiscal incentives, credit research and extension, and commercialization, all designed to stimulate industry and agriculture.

Exchange rate policy has been characterized by fixed rates with the dollar throughout most of the past three decades. Two exceptional cases are registered. In 1960, shortly after the democratic regime of Betancourt came to power, exchange rate controls were necessary to avoid capital outflows. By 1964 the controls were eliminated and the Bolivar had been devaluated from Bs. 3.35/US\$ to Bs. 4.50/US\$.

In 1983 the financial and economic crisis that followed the sharp reductions in oil incomes and the rise in international interest rates made imperative Government intervention in the exchange market. A progressive devaluation of the Bolivar (within a multiple rate system) and sharp restrictions of imports through import and foreign exchange control were established.

II.-Agriculture in Venezuela.- The agricultural sector in Venezuela contributes with 7.4% of GDP, and occupies 18% of the labor force. By subsectors, livestock contributes with 3.4%, crops with 3.3%, fisheries with 0.2% and the rest of the agricultural sector has a 0.3% share of GDP. In addition to that, 45% of the manufacturing sector is composed by the food industry; this implies an additional 9.4% contribution to the GDP by the food and fiber sector of The country.

Urbanization took place at an almost traumatic pace going from 26% of the total population in 1920 to 81.3% in 1985. The country has been a traditional food importer. In 1950 near 30% of the agricultural supply was imported while it is 50% in 1985.

In the 1920's, Venezuela was heavily dependent upon agriculture (36% of GDP) and 95% of exports and three-fourths of the population lived in the rural sector. In the 1930's, the country's economy shifted to the mining sector, with special emphasis given to oil and steel based activities (Table 3).

In the 1950's, the country saw an important influx of immigrants. The military regime resettled about 400,000 europeans and 40,000 colombians in 1950-58 through IAN (Wright, p. 88). These immigrants were responsible for a dynamic real growth of the sector during the period (annual 6.0%) while total GDP grew at an annual 8.4% in real terms also. One half of the growth in agriculture was made up by the livestock sector (dairy, cattle and poultry) (World Bank, p. 143-45, 1961). By then, Protinal, the largest animal-feed firm had been founded (1944). In a welcome environment, multinational firms established and expanded subsidiaries which had formerly had a market for their products as imports in Venezuela: milk, milling, feed and processed food firms (Wright, p. 91).

In 1958, under the democratic rule of Betancourt, the new policy of import substitution, Prebisch-style, was formulated. The basic idea was that the new, reliable processing sector was enlarging the market for agricultural raw materials that could be produced internally. In turn, the agricultural sector provides food for a rapidly growing urban population, it makes available income for the agricultural sector to purchase the products of new industries and it allows savings to be transferred to the industrial sector.

Cordiplan, (an agency at the level of Presidential Secretary), was created to implement planning on a national basis. The Agrarian Reform Law of 1960 was implemented. About 74% of all land redistributed was publicly owned (5.6 million hectares) as compared with 1.9 million has. of private property redistribution between 1960 and 1970. Therefore there was no change in the land tenancy structure. Policies benefitted mostly farmers in the 500 to 2.499 hectares range (Wright), through

directed subsidized credit, extension and insurance programs. Land title situation was unclear in about one-third of the cases, unenabling those farmers to obtain access to main policies of credit and extension.

The process of the food industry integration and diversification was also accompanied by increased market power concentration in that sector. Throughout the past two decades, three firms have controlled 80% to 95% of the market for feed and other three firms 85% of the market for wheat flour. Inputs for these industries were based on crops grown in temperate climate. Little research was done concerning the substitution of other crops suitable for local conditions previous to 1968, and little use of available evidence has been made to incorporate cassava or rice into their technology (Wright).

Agricultural production responded well to the incentives. Its value grew in an accelerated fashion and was followed by a reduction in agricultural imports as shown:

Percent of Agricultural imports in Total Consumption:

Year	% Agr. Imports
1958	45.0
1960	32.7
1970	25.2

A notorious growth took place in products used as inputs to the food processing industry: rice, sesame, cotton, sugar cane and tobacco. Also, in those destined to urban consumption: livestock products and vegetables.

The seventies witnessed a reversal in food import trends. Real crop production declined in 1970-73 at 1.1% per year but the decline was partially compensated by a 4.2% growth in the livestock subsector. Although food production was reactivated after 1974 in response to the extraordinary increases in investments coming from the booming oil prices, demand outpaced production and agricultural imports exploded (Table 4).

This process was curtailed by the sharp reduction in oil prices and rapid growth in the cost of funds in international money markets initiated in 1979. The economic and financial crisis that followed led to a foreign exchange control and the establishment of a multiple exchange rate system.

The multiple rate system enforced had a free market rate for dollar transactions with Banco Central de Venezuela and two preferential rates. A preferential rate for agricultural imports (both products and inputs) and debt payments at Bs. 4.30 per dollar. And for other imports, which were severely regulated by

prohibitions, prior licensing, and quotas, a preferential rate of Bs. 6.00 per dollar.

To avoid inflation, and given the large import component on the diets, particularly of the least-favored sectors of the economy, a system of administered prices was imposed. Finally, external debt payments were restructured.

Improvement signs have already been recorded. Imports, that reached US\$13,600 million by 1982 were US\$6,6 million in 1985. Agricultural production grew fast spurred by area increases from 1.5 million hectares in 1983 to 1.8 million hectares in 1985. Inflation has remained low (6% for 1985). But unemployment is high at around 13% however (up from 9.5% in 1982).

B.- Specific Agricultural policies.- The main goals of agricultural policy still are to substitute imports and foster domestic food production, to expand the agricultural frontier and improve productivity and to improve profitability in the sector.

Specific instruments used, along with the exchange rate system described, are price controls and commercialization, credit policies, and research and extension.

1.- Price controls.- Given the importance that imported foods have on the diets of the Venezuelans and the high concentration in the processing industry, the Government has felt the need to implement controlled consumer prices for several food items throughout the past three decades. Dairy, wheat, corn, rice and livestock meats and their processed products have been the target items.

Recent price controls have destimulated consumption of locally produced foods (rice, beef, roots and tubers, etc.) in favor of the imported ones (mainly wheat and coarse grains) by shifting consumption to the latter group and contracting the demand for those produced locally (Tables 4 A and 4 B).

A quick look at price evolution shows an increase for agricultural commodities with respect to other items in the rest of the economy. This shows the great effort done to promote food production by creating a profitable environment.

In the 1968-83 period the wholesale price index shows:

General Index	258.8%
Agriculture	376.3%
Manufacturing	232.8%
Machinery and Equipment	207.3%
Chemical Products	144.0%

This list shows that agricultural inputs have lagged in

price increases making agriculture more profitable. Also, given that 45% of manufactured output comes from food processing, the subsidy structure seems to have neutralized the higher input costs to this industry, in favor of consumers.

Two cases are quite relevant. White rice (5% broken grains) had a consumer price increase of 55% in 1980-84 to reach Bs./8.50 per kg. while wheat flour had a 20% increase to reach Bs. 3.50 per kilo, and pasta had no increase to remain at Bs. 7.00/kilo.

White corn flour, with over 70% of local corn increased by 85% in those four years to reach Bs. 6.50/kg. while yellow corn flour, with 95% imported corn increased by 27% to close at Bs. 3.50/kg.

Let us take a look at price discrepancies as of 1984 and 1985 for some imported items.

		Feb. 1, 1984		Dec. 1, 1985	
		Minimum Farm Price	Import Price at Bs. 4.30/US\$	Minimum Farm Price	Import Price at Bs. 7.50/US\$
White Corn	1,800		Bs. 697 US\$ 162.00	3,000	Bs. 1,125 US\$150.00
Yellow Corn	1,600		Bs. 654 US\$152.00	2,800	Bs. 1,058 US\$141.00
Wheat			Bs. 702 US\$ 163.25		Bs. 1,268 US\$169.00
Sorghum	1,400		Bs. 606 US\$ 141.00	2,200	Bs. 1,013 US\$135.00

A contradictory situation emerges when the Government intends to stimulate local production through high prices and also wants to keep the price of food low to the urban consumer. The higher the national component in the processed foods, the higher the cost to the manufacturer. As a result, there will be inflationary pressures or direct subsidies will have to increase (Table 5).

In 1984, the preferential exchange rate system costed Bs. 3,000 million (US\$230 million) to the Government (Hernandez).

Commercialization policies also changed drastically with the elimination in 1985 of Corporacion de Mercadeo Agrícola (CMA) which had been created in 1971 to ensure adequate supplies of food to consumers at affordable prices by importing food to cover domestic shortages; buy local production at minimum set prices

and provide cleaning, drying and storage. Three products were mostly favored by this institution: maize, sorghum and rice. In the seventies, CMA increased its market participation to buy up to 75% of rice production, 70% of sorghum and 65% of maize.

Since its creation until 1985 when it was terminated CMA absorbed near US\$ 8,500 million, which were represented by direct subsidy transfers, red tape and plain inefficiency.

The elimination of CMA implies that MAC handles import licenses and grains are imported directly by users. CMA handled imports, directly until 1979 when the private sector took over, previous license approval from CMA.

A concerted price policy to reduce the inflationary impact to the consumer while local production reacts favorably to the stimulus created is in effect. A mixed body including the ministers of agriculture, finance and the treasury along with processors and producers tackle prices and problems making "changes without decrees" (Latin America Weekly Report, Sept. '85).

Starting in 1983, the Government decided to eliminate altogether the direct price subsidies even for basic food items. The last one to go was the dairy subsidy, in mid-1984. Other subsidies eliminated were those protecting rice, corn flour, vegetable oils and feed grains.

To compensate for this direct subsidy elimination, important reductions in input costs were established. Therefore, interest rates the rediscount rate for agricultural loans were reduced as well as a 50% subsidy on fertilizers was approved. Fertilizer subsidy had been eliminated in 1981 but after a tripling of its price, the subsidy was reimplemented.

A package of special credit, extension and crop insurance policies has been designed to cover priority items in an effort to reactivate its local production in the mid-term. The most relevant are cereals (rice, corn, sorghum), oilseeds, pulses, and livestock products and the traditional export crops (coffee, cocoa, and sugar cane).

2.- Credit Policies.- Traditionally, this tool has concentrated efforts in supplying cheap, abundant credit to large producers and food processors, neglecting the small farmer (Wright). In 1975, Banco Agrícola y Pecuário (BAP) was redesigned in an effort to give better coverage to small as well as larger farmers. Two institutions replaced its functions: ICAP, basically oriented to small and medium farmers and BANDAGRO, created in 1969, dedicated to larger producers and food processors.

In 1974, FCA (Fondo de Credito Agropecuario) was created to supply infrastructure and farm machinery credit for the agricultural sector under MAC. It does not grant direct credits; rather, they are channeled through other institutions.

Presently, commercial banks are obliged to place 22.5% of portfolios in farm loans: 17% to growers and 5.5% to agro-industry.

In 1984, the Government reformed the banking laws, lifting the repayment limit from 5 to 10 years, with 3 years grace. Interest rates for farmers were chopped from 11.7% to 8.5% at Bandagro. They have been at 3% for ICAP loans (Table 6).

Credit recovery has always been a problem. With the new measures taken, it has improved substantially to about 90% for commercial growers and 75% for campesinos. Regional managers of ICAP offices are now evaluated, among other criteria, on the basis of credit recovery. This brought as a consequence a reduction of loans granted to risky crops (like cassava) and in favor of secure ones (grains). For grains, loans can be recovered at sales time, given the nature of the commercialization process. For cassava, marketing is not centralized at storage points and there is no defined harvesting time. So, this procedure of discounting the value of the loan is not viable. Therefore, lenders have no control over cassava sales at all.

Even the system to provide credit to small farmers constitutes a tool to divert Venezuelan agriculture away from its traditional crops and into the new (ecologically maladapted) food and feedstuffs.

The total amount of credit directed to agriculture reached its peak in 1977 to drop by almost Bs. 2,000 per year thereafter (Table 7). At the same time, fiscal outlays for agriculture go from 8.7% of the total in 1974-78 to 6.0% in 1979-83, reflecting changes in priorities that coincided with the austerity policies and monetary restraint.

In 1984, major revitalization actions for agriculture included: payment of government agricultural debt to producers, expanding the availability of preferential private and public bank credit, 50% subsidy on fertilizer prices, increased output prices for a selected set of agricultural items (cereals, pulses, livestock products), and an import quota system to ensure purchase of domestic production by the food and feed processing industry.

Crop insurance is an added policy element designed to attract investment into agriculture. In 1980 Congress created AGROSEGURO with shareholders being FCA and IAN. It covers total

or partial losses in rice, corn, sorghum, cotton and peanuts, when they are due to uncontrollable natural causes. Livestock deaths of the same nature are also covered.

Also, FCA covers losses of financial intermediaries when MAC declares proved disasters to qualify under the program. Maximum coverage limits have been defined for livestock, fisheries, coffee, cocoa, oilseeds, cereals, sugar cane, and fruits. Roots and tubers are not included in the list.

3.- Government Expenditures.- Government expenditures in agriculture per hectare by 1980 were the highest among 10 american countries surveyed by Elias, and Government expenditures on agriculture per person employed in agriculture were second after the US. Expenditures in research and extension increased fast in the fifties to stabilize thereafter until 1977, the last datum available, at about US\$ 50 million (1960 dollars) per year. Irrigation expenditures also grew notoriously in the period of analysis presented by Elias (1950-80).

FONAIAP, the research institution has 5 regional centers and is based in Maracay. In 1980, MAC established the Integrated Program for Agricultural Development (PRIDA) which gives technical assistance to Campesino Organizations.

B.-Concluding Comments.- The political and economic forces behind the present import substitution strategy are quite complex. Food processors, which are, for the most, direct importers of their own raw material, exhibit a good deal of market power concentration. They exert effective pressures on policy makers to protect their own interests. This has been probably the reason behind an increasingly specialization, both in terms of production and consumption, on a few imported items that are used as inputs for the local processing firms. Jaffe and Rothman concluded the following:

"In general, the terms of interchange are heavily biased in favour of industry, creating a distorted economic structure with an increasing economic and technological dependence upon industrialized countries. The changes in food consumption pattern are clearly part of this complex and, therefore, part of the distorted economic structure, which in the final analysis is the basis of underdevelopment.

Some of the elements defining this implicit food policy, which emerge from our analysis, are:

.The change towards high-import content and ecologically maladapted foods.

.The tendency towards manufactured foods incorporating a high degree of industrial processing, eg, the change from husked maize to pre-cooked maize flour.

.The trend towards high-cost nutrients, as shown by the increase in meat consumption and the growth of the animal feeds industry, amongst others" (Jaffe, Rothman).

III.- Status Quo of Cassava in Venezuela.-

Cassava production has stagnated in the country at about 330.000 tons per year since 1960 and with yields of 8 tons/ha in 40.000 hectares (Table 8).

A.- Present Status.- Production is highest in the Eastern part of the country (Table 9), and its share has grown in the 1960-85 period due to gains in production in Bolivar and stable production in the other States (BCV, Raices y Tuberculos, 1974), Consumption of Casabe (a kind of bread made out of cassava flour) is quite important in this region.

Our survey of 50 producers conducted in Monagas, in May 1986 revealed that about half of the farmers surveyed did not use machinery, half of them used intercropping with maize, fertilizer use was mostly associated with the presence of maize as well as use of other chemicals (Table 10). Among the 50 farmers surveyed, the average farm had 23.5 hectares and 2.2 hectares under cassava. Yields fluctuate widely from around 5 tons/ha to over 20 tons/ha depending on technology and crop management. Analysis of the survey is under way now.

Except for the highly mechanized farmers, use of purchased inputs in cassava is quite limited. Most farmers plant bitter varieties for sale to "casaberas" or to process their own casabe, and they also plant a parcel (up to half a hectare) of sweet varieties for home consumption and occasional sales.

The major state producer of cassava is Zulia, in the West, with 15% of total production. This area as well as the rest of the country, produces sweet varieties as opposed to the Eastern section of the country, where bitter varieties are predominant.

The Andean States are also important producers of the root with 31% of the total. However, per capita production here is lower due to larger population concentration.

With respect to consumption, there are no recent estimates of cassava uses in the country. A 1974 study conducted by BCV reveals that about 38% of all cassava is destined to animal feed, 40% is consumed in fresh form by humans, 12% is consumed in the form of casabe, and the rest, 9%, goes to starch production (Table 10 A).

In the 1965-84 period analyzed, per capita consumption of cassava decreased at an annual 3.1%, the sharpest fall among

carbohydrate foods. This reduction was accompanied by a 3.8% annual increase in its real retail price, also the highest price increase among carbohydrates (Tables 11 and 12). For Caracas, the INN 1981 nutrition survey, reveals that cassava is mostly consumed by lower income groups (IV and V), with an annual per capita consumption of 8.1 kgs. for the lowest income group (V), 6.2 kgs for the middle low (IV) group and only 3.6 kg for the upper income groups.

A miscalculated effort was made in the late seventies to incorporate cassava into the main stream of agroindustry in Venezuela. The amount of research done with the crop is quite impressive, both at the agronomic level (FONAIAP, UEV, UDO, LUZ, UNELLEZ FUNDATEC, etc.), and at the utilization end (UEV, UDO, Protinal, etc.).

In those years, cassava was seen as an important alternative in the import substitution policies of the Government. Eleven drying plants were created throughout the country in 1975-80 at the cost of about US\$ 25 million. They all are closed as of 1986. Most of them never got off the ground. Careful analysis reveals that soft credit lines were formulated by the same institutions that sold the machinery, without considering the economic feasibility of success of those plants in terms of location, market expansion, social impact, labor needs, etc. Total installed capacity for these Cassava Plants is 250.000 tons or 75% of actual production.

2.- Econometric Analysis of the Demand for Fresh Cassava.- Data from the INN only refers to quantities of products consumed. There is no expenditure information. Therefore, only time series data were used to calculate the effects of changes in incomes, prices and urbanization trends on per capita consumption of cassava. The period of analysis chosen covers the years 1,965-84.

Urban population grew faster than total population at 4.2% per year. Urbanization has a negative implication on cassava demand that goes beyond the effect of causing higher consumer prices due to the obvious increase in marketing costs. Because the root is highly perishable, urbanization poses special difficulties in market access. Effective barriers of entry emerge with the subsequent reduction in competitiveness in the market place. The lower degree of competition converge lower volumes of trade than would have taken place under a more competitive environment.

The model proposed to estimate per capita demand for cassava includes its own real retail price, real retail prices of other carbohydrates, per capita real incomes and total urban population as independent variables.

Parameter estimates show that urbanization has had a marked negative impact on consumption of fresh cassava in the country. Income did not have a significant effect on its consumption at the aggregate level most likely because it is a significant variable at lower income levels (as is the case in Colombia, Indonesia and Brazil, for example) and not significant or even negative at high income levels. So, in the aggregate the income elasticity is very low, 0.08 (and not significantly different from zero) (Table 13).

Per capita consumption of cassava is also quite responsive to prices. The marked growth in its own price (at 3.8% per year) had a contractionary effect on its demand of 0.38% per year (own price elasticity of 0.10). Substitution away from cassava consumption was also caused by wheat and rice prices (cross price elasticities of 0.13 and 0.18).

These results confirm that cassava has been discriminated against not only at the supply level, where policies encourage production of imported food items but at the demand level as well, with discriminatory consumer price policies that have affected consumption of this root in favor of an imported cereal like wheat.

B.- Potential Demand for Cassava.- As we have seen, cassava has been left out of the main stream of import substitution and agroindustrial policies that have characterized the past three decades of Venezuelan agricultural development. But its excellent agroecological adaptation to the different environments of the country make the root an obvious candidate in the long term to substitute for imported food energy sources in both the food and the feed processing industries.

The obvious impediment at present is the complex set of political economic forces that propitiated and maintain the actual state of things. The oligopolies existing in wheat milling and feed manufacturing are also heavily involved in the grain import business. These interest groups play a vital role in the price and production policy decision-making process.

There are encouraging signs in both industries with respect to utilization of local food items in their processing technologies. The wheat millers have experimented with cassava and rice flour. They will have to use, by law 15% to 20% of rice flour in production of pasta.

With respect to feed, Protinal, the largest feed and poultry producer in the country (with 30% of the feed market) has been actively involved in dried cassava research for animal feed. For the last four years, they have been operating a 100 ha. plantation in Monagas (Eastern part of the country) where experiments with mechanized planting and harvesting are

progressing satisfactorily. A 250 sq.m. drying floor, and a Thailand type chipper following CIAT's specifications were built to keep abreast of the possibilities in this area. The same firm has conducted experiments in a "Central Yuquero" in the Eastern part of the country, where artificial drying experiments are being conducted.

Protinal thinks that the drying floors have a bright future in that region of Venezuela where abundant marginal but mechanizable land exists, drying conditions are excellent (four months of dry season) and there is a cassava tradition that goes back several decades. Casabe prices have increased relative to wheat products; it is now more expensive than pasta and bread at around Bs. 10/kg. and its consumption has declined. Drying cassava offers an alternative market for farmers in that region.

Purina, the second largest feed manufacturer has also shown interest in dried cassava, following the example of its sister company in Colombia, which has been a major user of dried cassava chips produced in the Atlantic Coast of that neighbour country.

Fresh cassava offers also new possibilities to reduce the negative impact associated with the high perishability of the root in a rapidly urbanizing society. The new technology to store fresh cassava in plastic bags and treat it with thiabendazol could have a tremendous impact on reducing retail prices and expanding volumes sent into major urban zones. By 1986, farmers' prices of fresh cassava were around Bs. 0.75/kg to Bs. 1.10/kg while its retail price in Caracas was Bs. 5.95/kg.

The marketing margin seems excessive in a city with excellent roads for and with an appropriately endowed wholesale market (Los Coches). Reducing perishability will enable farmers from more distant places to enter the market. Retailers will see their losses cut and they will also be able to negotiate larger volumes at wholesale outlets.

Increased market access and lower commercialization losses due to use of the plastic bag technology should imply sharp reductions in retail prices and markedly higher volumes of cassava being traded into the cities. In a country of high incomes, where food marketing usually conveys a high value-added to the final product this type of technological innovation has a high chance for success.

We turn now to analyze the prospects for cassava demand both as a food item that competes with other carbohydrates and as a feed source.

1.- Carbohydrate Foods.- Venezuela continues to be dependent on imports for over 50% of basic agricultural commodities (and perhaps 30% of total food consumption). Food

imports (mostly cereals, oilseeds, dairy and their products) boomed after 1973, following the rapid oil price increase (Table 4). In the 1965-84 period of analysis, the highest gains in per capita consumption went to rice at 2.2% per year. Actually, per capita consumption of rice in the 1965-80 period grew at an annual 3.1% accompanied by an equally impressive retail price reduction (in real terms) of 2.1% per year. In the eighties, white rice prices increased quite fast in real terms from Bs. 1.05/kg to Bs. 1.45/kg in 1985 (5% broken grains). Accordingly, per capita consumption of rice (paddy equivalent) went from 40.0 kilos in 1980 to 25.7 kilos in 1985.

Per capita consumption of all major carbohydrates decreased during the period of recession, 1978-85 except that of wheat, for which a favorable price policy for bread and pasta meant a rapid real retail price reduction. (Tables 12 and 14).

Reductions in the price of rice in the 1965-84 period are the result of rapid adoption of improved, high yielding varieties, (HYRV) a process that started in 1959. By 1982 it is estimated that out of 227,000 hectares cultivated with rice, about 200,000 used HYRV (mainly Araure 1) of which 30% was irrigated (M.J. Rosero in Dalrymple). By 1985 area harvested was 148,000 hectares of which 40,000 were irrigated. Government credit for non-irrigated rice has been declining. Yields have been increasing in the eighties due to a higher proportion of irrigated rice. They were of 3.2 tons/ha. in 1985 (USDA Grain and Feed Annual Report).

Venezuela is self-sufficient in rice since the early sixties and some exports have been registered of small amounts. Mechanized upland and a more intensive irrigated system are the predominant methods of cultivation.

Industrialization is mainly for milling. Of the 35% resulting from milling, 23% goes to non-feeding uses at poultry farms and 12% goes into animal feed. Between 2% and 4% of white rice goes into brewing and more elaborated foods.

Per capita consumption of white rice was of 17 kilos by 1985 with a distribution by socio-economic strata where its total consumption increases with income level.

Corn consumption in per capita terms had no significant trend over the 1965-84 period, while the real retail price of corn flour increased at 3.3% per year.

About 75% of domestic availability goes to the flour processing industry. The rest goes into feed manufacturing. Apparent per capita disappearance in 1985 was about 30 kgs. Corn consumption increases as income level decreases (Hernandez, IESA). It is a basic staple at low income levels. The corn

processing industry has a high degree of market power concentration.

Wheat is almost exclusively imported and constitutes the basis of the diet with 21% of the total protein and 40% among those of vegetable origin coming from it (Hernandez Doc. #1). Venezuela imports high quality, high price wheat mostly from the United States (UCV Economia).

About 90% of wheat reaches a second milling phase. Of that share, 59% goes into bread and pastry, 25% into pasta, 5.5% into cookies, and 10% into domestic use of wheat flour. Milling is highly concentrated while pasta and bread processing have lower degrees of market power concentration.

Per capita availability of wheat was around 56 kgs in 1985. Bread consumption increases with income level while with pasta occurs the contrary (Hernandez, IESA).

Per capita consumption of fresh carbohydrates shows no significant trend for potatoes and plantains and a decrease for cassava. Prices of these three items increased in real terms (Table).

Should present trends continue, the diets of the Venezuelans will specialize even more in imported wheat, with rice and corn having a chance to maintain their shares, given the strong Government support to producers. Potatoes, cassava and plantains will continue to be substituted away due to the consumer pricing policies favoring wheat.

2.- Meats. The livestock sector has been very dynamic in the past two decades. Its contribution to GDP has increased, spurred by a fast growing poultry industry although pork, beef and dairy made important gains.

Per capita consumption of poultry grew in 1965-84 at an annual 5.9%, of pork at 23% and of beef at 1.3%. The faster growth for poultry was accompanied by a continued reduction in its real retail price at 2.4% per year, the result of rapid adoption of modern technologies (Table 11).

In per capita terms, beef has been surpassed by poultry (with 16.7 kgs versus 19.6 kgs) and pork is a distant third with 6.2 kgs.

Poultry has been specially favored not only by the favorable grain import policies but also by direct action to foster adoption of modern technologies. Conversion rates for feed/meat went from over 3.0 in the early sixties to about 2.1 presently. Poultry prices have been subject to direct Government control through an administered maximum P.V.P. (consumer sales price).

Due to technological improvements, the relative price of poultry vis-a-vis other meats decreased sharply. Also, the relative price of poultry with respect to the prices of corn and sorghum declined (Cuadro 21 Rivas).

To sustain the rapid growth in feed use, the production of this item had to multiply several times its size. In the period 1965-84 feed production grew at an impressive 10.4% per year. Sorghum production also grew quite fast at 5.1% per year. In 1968, 97% of sorghum domestic availability was imported while in 1981 this proportion went down to 60% (Rivas et al.). Increases in production came 70% from area increases and 30% from yield gains (Trapido). Present yield levels are at 1.900 kgs/ha. (USDA Grain and Food Annual), and production for 1985 was around 590.000 tons, while imports reached 1 million tons.

Maize and sorghum imports outpaced local production of those items growing at an annual 23.3% in 1965-84. In short, the gap between import and locally produced coarse grains has been widening and will continue to do so.

Should present trends continue Venezuela will have to produce close to 6 million tons of feed by the year 2,000 and will have to import around 2 million tons of coarse grains (See III.C.3 in page 17).

C.- Potential Demand for Cassava.- Data presented indicates that the basis of the Venezuelan diet is formed by a set of products (wheat, corn, sugar, vegetables, oils, dairy, poultry, eggs) with a dominant import component directly or indirectly. Diet diversification has been lost. Caloric and proteic intakes for the population as a whole have decreased slightly but this decrease has been more visible at the lower income levels (Hernandez Doc. 1).

The present situation is likely to aggravate unless corrective measures and new perspectives are considered. Cassava can increase its contribution both for human direct consumption in fresh form and dried, as a feed ingredient.

1.- Basic Assumptions.- Using the model estimated from time series data, we can project cassava consumption needs into the future. From the basic model:

Per Capita Consumption = F (Prices, Income, Urbanization)

one can assume changes in the independent variables and calculate the new levels implicit in the dependent variable.

A rather conservative scenario has been assumed. Per Capita real incomes in 1985-2000 will increase at an annual 1.0%,

population will grow at 2.8% per year, and the real retail price of cassava will decrease at an annual 1.0% while other real prices remain constant.

The price fall assumption is based on the assumption that the plastic bags technology will be gradually adopted. With this technology, consumers will pay less, farmers will receive more (Janssen and Wheatley) by means of a significant reduction in waste and marketing costs as well as the formation of stronger markets.

Therefore the assumption of a reduction in the retail price of cassava rests initially on the implementation of the new storage technology. In such a case the rate of reduction in price could be much higher than the one proposed for this exercise. An additional assumption for projections is that with this technology, commercialization losses of cassava will be reduced from an estimated present level of 25% to 15% in the fresh market. If there is a parallel development of the drying industry, losses will be reduced to 5% since an additional 10% which is cassava not suitable for the fresh market due to quality problems (small size, or broken), and that is currently left on the field, could be utilized by this industry. Therefore, the final effect on additional production requirements will be 20% less due to a better usage of the crop.

2.- Fresh Cassava.- The 1984 per capita consumption level of 18.6 kilos will increase to 19.1 kilos by the year 2,000. The increase in per capita consumption is the result of the own-price decrease (Table 15).

Under those circumstances, implied cassava production will reach 541.800 tons (over the 331.000 tons produced in 1984). Again, a 10% waste reduction equivalent around US\$ 4 million) is assumed to be associated with the new storage technology. Therefore increments in production for the year 2,000 will amount to 156,800 tons, or 15,680 new hectares of production with a yield of 10 tons/ha (Table 15).

3.- Dry Cassava.- Our estimates indicate the following:

- i) Dry cassava competes with locally produced sorghum, but not with imported sorghum at the preferential exchange rate (Tables 16 and 17).
- ii) Against local sorghum cassava drying is a profitable alternative for feed manufacturers, entering in the optimal least cost solutions at 80% of the price of sorghum. Sorghum has a higher protein content and, for that reason, cassava must cost less.
- (iii) Therefore, the viability of its production remains subject to policy decisions.

Whether cassava is incorporated in the main stream of import substitution and feed processing will be a political decision impending upon both industry and Government willingness to stimulate this promising root.

From our time series demand estimation of pork and poultry in Venezuela (Sanint et al.) we translated those elasticities into projected consumption of those two types of meat into the year 2,000.

It was assumed (i) that the present ratio of feed going into broilers and layers remain constant (i.e., there will be an equally dynamic demand for eggs, which appears quite reasonable) and (ii) pork and poultry feed will continue to represent 85% of that market (dairy and other uses will also show important growth; again, a proposition with high level of likelihood).

The model predicted for the year 2,000, per capita consumption of poultry meat at 25.2 kilos (up from 16.9 kg in 1984), that of pork meat at 7.9 kilos (up from 6.4 kg in 1984) and feed use at 5.7 million tons (from 3 million in 1984) (Table 15).

Substituting only 10% of dry cassava chips into the feed formulas of the year 2,000, 573.700 tons of dried cassava will be required (that will substitute about US\$ 57 million of coarse grains imports). At a 2.5 conversion rate of dry to fresh cassava, 1.4 million tons of fresh cassava will be required to meet this challenge and 137,996 new hectares will have to be cultivated (assuming yields of 10 tons/ha which are rather conservative). The exercise also assumes that 10% of what is produced for fresh cassava consumption can be incorporated into dried cassava, since that proportion is usually left on the ground at harvest time because it will not meet market standards. But those remainings ("colas") are perfectly acceptable for drying.

Total needs for additional cassava (in both the fresh and feed markets) by the year 2,000 reach 1.5 million tons, in 153,676 new hectares and with 34,546 new jobs generated in the process.

IV.- Concluding Comments.- Venezuela has made considerable efforts to substitute food imports and reduce its level of dependence on foreign suppliers. The food processing ability of the country has expanded very rapidly but the raw materials demanded contain a high proportion of imports. Wheat is almost one hundred percent imported, while 60% coarse grains use in feed production come from abroad. This, in spite of the massive subsidies and price stimulus given to farmers of those crops, and rapid growth in corn and sorghum production.

In terms of potential, cassava has much to offer. It is the cheapest source of energy in the tropics. That undeniable evidence should be put to work. The crops ability to grow under a very wide range of ecosystems and the present low yields, indicate that Venezuela could use many of its unproductive lands to cultivate cassava and achieve substantial productivity gains.

The present dilemma of substituting expensive local grains for cheap imported ones and at the same time provide cheap, abundant food to the urban consumer must be broken by means of productivity, rather than area expansion, in order to keep prices of local products low and competitive.

Increasing sorghum and corn yields far beyond their present levels (which are based on heavy use of subsidized fertilizers) is unlikely. But with cassava, it is a different story. Present average country yields of 8.0 tons/ha are very low. Protinal, under field conditions obtains 15-20 tons/ha. At those levels, cassava becomes a much better alternative than coarse grains in Venezuela. An exhaustive discussion on this topic can be found in Rios et al.

The case of fresh cassava also merits attention. With the introduction of a very simple new technology that does not require further more than the willingness to apply it, because it is quite inexpensive, impressive results can be achieved, as the Colombian experience (Bucaramanga pilot project) demonstrates.

The political and economic forces behind the present import substitution strategy are quite complex. Food processors, which are, for the most, direct importers of their own raw material, exhibit a good deal of market power concentration. They exert effective pressures on policy makers to protect their own interests. This has been probably the reason behind an increasingly specialization, both in terms of production and consumption, on a few imported items that are used as inputs for the local processing firms.

As some of these firms (Protinal, Purina) turn their attention to cassava, the future of this root may be bright in Venezuela.

TABLE 1

Statistical Profile*

Area (Km ²)	898,805				
Population, Total 1985 (81.3 % urban)	17,355,000				
Annual growth rate 1970-85	2.9				
Birth rate (1984)	29.9				
Mortality per 1000 inhabitants (1984)	4.6				
Infant mortality per 1000 live births (1984)	27.3				
Life expectancy at birth (1984)	58.6				
Percentage of literacy (1984)	85.95				
Labor force by sector (1985)	(Percentages)				
Agriculture	14.5				
Mining	1.3				
Manufacturing	15.7				
Construction	8.6				
Others	59.9				
	1981	1982	1983	1984	1985**
Real Production	(Growth rates)				
Total GDP (market prices)	-0.3	0.7	-5.6	-1.4	-0.4
Agricultural sector	-1.9	3.6	0.4	0.8	7.0
Mining sector	-2.5	-10.2	-6.3	1.9	-4.8
Manufacturing sector	-2.5	4.1	-1.7	4.6	3.3
Construction sector	-2.1	-8.4	-13.3	-34.4	-17.4
Central Government	(Percentages of GDP)				
Current revenues	32.5	26.9	24.7	28.5	28.6
Current expenditures	19.9	18.7	18.6	19.8	19.5
Current savings	12.6	8.1	6.1	8.7	9.1
Capital expenditures	14.6	13.0	8.4	6.0	6.9
Deficit or surplus ¹	-2.0	-4.9	-2.3	2.7	2.3
Domestic financing	2.4	2.2	2.8	-1.4	-2.3
Money, prices and salaries	(Growth rates)				
Domestic credit	20.5	22.4	6.2	13.3	-7.8
Public sector	36.7	85.9	76.1	n.a.	n.a.
Private sector	9.1	12.7	5.5	16.7	8.1
Money supply (M1)	9.5	5.6	20.7	23.8	5.8
Consumer prices (annual average)	16.0	9.7	6.3	12.2	12.0
Real wages	-5.4	-0.1	-7.2	-5.2	n.a.
Exchange rate	(Annual Average)				
Official rate (national currency units per dollar)	4.30	4.30	4.30	7.02	7.50
Real effective exchange rate (Index 1980 = 100)	91.2	85.7	90.7	115.4	112.6
Terms of trade (Index 1980 = 100)	99.0	98.3	95.2	101.5	99.0
Balance of payments	(Millions of dollars)				
Current account balance	3,999.7	-3,999.2	4,426.7	4,970.3	3,927.0
Merchandise balance	7,840.2	2,588.8	8,161.8	7,973.6	7,604.0
Merchandise exports (FOB)	19,963.2	15,386.2	14,570.5	15,850.8	14,197.0
Merchandise imports (FOB)	-12,122.9	-12,797.4	-6,408.7	-7,877.2	-6,593.0
Net services	-3,431.4	-5,985.8	-3,524.5	-2,824.9	-3,535.0
Transfers	-409.2	-602.2	-210.6	-178.4	-142.0
Capital account (net)	-1,881.9	-1,656.9	-4,098.5	-3,506.6	-2,577.0
Change in net reserves (- = increase)	20.0	7,692.6	-336.7	-1,567.2	-1,350.0
External public debt	(Millions of dollars)				
Disbursed debt	11,382.0	12,122.5	12,911.4	17,248.6	n.a.
Debt service actually paid	2,588.3	3,220.8	2,655.8	2,536.4	n.a.
Interest payments/export of goods and NFS	(Percentages)				
	5.9	11.1	10.9	8.6	n.a.

* Where necessary, the items of information presented in this table are defined in the list of sources appearing on page 382.

** Preliminary estimate.

¹ Capital revenue is taken into account in calculating the deficit.

n.a. Not available or not applicable.

Table 2. Annual Rates of Growth of Real GDP, Agriculture and its Subsectors. Venezuela.

	Total	Agric.	Crops	Livestock
1958-73	5.5	4.3	2.7	6.6
1973-78	6.3	4.7	5.1	7.3
1978-85	-1.5	1.9	0.3	3.1

Source: Own calculations.

Table 3 . Evolution of Exports and Population Composition,
1920-1980.

Año	Percent of Exports		Percent of Population	
	Coffee-Cocoa	Oil	Rural	Urban
1920	92,0	2,0	74,0	26,0
1930	15,0	83,0	65,3	34,7
1940	4,0	94,0	60,6	39,4
1950	3,0	96,0	46,6	53,4
1960	2,0	90,0	32,6	67,4
1970	0,8	90,2	24,3	75,7
1978	-	82,5	24,3	75,7
1980	0,2	92,0	23,9	76,1

Source: Dirección General de Estadísticas.

Table 4 . Agricultural Imports and Production. Venezuela
1970-78.

Y e a r	Value of Agricultural Production (Millions of 1960 Bs.)	Imports of Processed and Nonprocessed Agric.Goods (Millions of 1960 Bs.)
1970	4.137	1.471
1971	4.197	1.248
1972	4.141	1.393
1973	4.355	2.021
1974	4.663	2.912
1975	5.005	3.981
1976	4.922	3.650
1977	5.306	6.141
1978	5.634	6.450

Source: BID, FCA Project, 1984.

TABLE 4A

Productos cuyo consumo aumenta al disminuir
el estrato de ingreso

E s t a d o s

	<u>Carabobo</u>	<u>Zulia</u>	<u>Yaracuy</u>	<u>Portuguesa</u>
Productos	Pastas (1)	Pastas (1)		Pastas (1)
	Leguminosas (1)	Leguminosas (1)	Leguminosas (1)	Leguminosas (1)
	Azúcar (1)	Maíz (1)	Maíz (1)	Maíz (1)
	Gaseosas (1)	Azúcar (1)		Gaseosas (1)
	Aves (1)	Aceite Vegetal (1)		Pescado (3)
	Huevos (1)	Pescado (3)	Huevos (1)	Huevos (1)
	Embutidos (2)	Leche en Polvo (1)	Leche en Polvo (1)	
		Embutidos (2)		

(1) Alto componente importado; (2) mediano; (3) bajo
Fuente: FUNDACREDESA. Elaboración propia.

TABLE 4B

Distribución porcentual de aportes calóricos y protéicos en la dieta
de acuerdo al origen de los productos más importantes (1982) (*)

Producto	Aportes Calóricos			Aportes Protéicos		
	Aporte Total %	Aporte Nacional %	Aporte Importado %	Aporte Total %	Aporte Nacional %	Aporte Importado %
Arroz	7,74	7,74	--	5,69	5,69	--
Maíz	14,64	2,77	11,87	10,77	2,04	8,73
Trigo	15,88	0,12	15,76	21,22	0,17	21,05
Caracota	1,61	0,47	1,14	4,28	1,24	3,04
Frijol	0,19	0,19	--	0,62	0,62	--
Aceite Veg.	10,95	3,07	7,88	--	--	--
Ocumo	0,20	0,20	--	0,12	0,12	--
Papa	0,87	0,78	0,09	0,80	0,72	0,08
Yuca	1,35	1,35	--	0,37	0,37	--
Aguacate	0,23	0,23	--	0,07	0,07	--
Cambur	2,78	2,78	--	1,64	1,64	--
Naranjas	0,46	0,46	--	0,31	0,31	--
Piña	0,07	0,07	--	0,02	0,02	--
Plátano	1,93	1,93	--	0,69	0,69	--
Cebolla	0,15	0,15	--	0,18	0,18	--
Tomate	0,10	0,10	--	0,29	0,29	--
Azúcar	15,91	4,79	11,12	--	--	--
Cacao	0,20	0,20	--	0,22	0,22	--
Café	0,06	0,06	--	0,28	0,28	--
% del Total	75,32	27,46	47,86	47,57	14,67	32,90
% del Sector Vegetal	100	36,46	63,54	100	30,84	69,16

Fuente INN, CORDIPLAN. Cálculos propios con la participación del Ing. A. van Kesteren.

(*) Los productos señalados aportan más del 95% de la energía y proteína consumidas.

TABLE 5 . Venezuela, Internal to International Price Ratios, 1972-82

ITEMS	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Maize	-	1.00	1.22	1.22	1.65	1.56	1.56	1.85	2.46	2.64	3.21
Sorghum	1.00	0.79	0.71	0.97	1.22	1.54	1.41	1.15	1.16	1.47	1.93
Sugar	-	1.00	0.55	4.19	1.18	1.48	1.64	2.34	0.95	1.53	2.95
Beef	-	1.00	0.91	1.04	1.08	0.87	-	-	-	0.99	1.01
Dairy	-	-	-	1.00	1.37	1.45	1.36	1.28	1.80	1.41	1.41
Pork	-	-	-	-	1.00	1.16	0.72	1.08	0.85	0.99	1.01

Sources: 1982 Statistical Yearbook, IMF

MAC, Anuario Estadístico

Table 6. Real Interest Rates. Venezuela 1979-1984.

Year	Nominal Interest Rate				Rate Inflation	Interest Real Rate			
	Commer. Bank	ICAP	BANDAGRO	FCA		Commer. Bank	ICAP	BANDAGRO	FCA
1979	11,6	3,0	11,2	7,5	12,3	-0,7	-9,3	-1,1	-4,8
1980	12,6	3,0	11,2	7,5	21,6	-9,0	-18,6	-10,4	-14,1
1981	14,5	3,0	11,2	7,5	16,0	-1,5	-13,0	-4,8	-8,5
1982	17,6	3,0	11,2	7,5	9,7	7,9	-6,7	1,5	-2,2
1983	16,6	3,0	11,2	7,5	6,8	9,8	-3,8	4,4	0,7
1984	8,5 <u>1/</u>	3,0	8,5	8,5	16,0	-7,5	-13,0	-7,5	-7,5

Source: BID.

TABLE 7

Sector AgropecuarioFinanciamiento de parte de Entidades Públicas y Privadas

(millones de bolívares a precios corrientes)

<u>Años</u>	<u>Banca Comercial</u> (1) (*)	<u>Entidades Públicas</u>			<u>Total</u> (2)	<u>Financia- miento</u>
		<u>BANDAGRO</u>	<u>ICAP</u>	<u>FCA</u>		<u>Total</u> (3)=(1)+(2)
1975	672	917	917	1.204	2.890	3.562
1976	3.242	691	951	329	1.971	5.213
1977	3.725	1.112	1.130	227	2.469	6.194
1978	1.425	1.305	1.319	295	2.919	4.344
1979	398	1.690	1.097	483	3.270	3.668
1980	1.411	1.895	1.322	264	3.481	4.892
1981	1.777	1.493	1.629	201	3.323	5.100
1982	1.280	1.389	1.188	272	2.849	4.129

* Los flujos crediticios fueron calculados como la diferencia entre los saldos de la cartera agrícola a fines de un año determinado respecto al saldo de la cartera a fines del año inmediatamente anterior.

Fuente: Banco Central de Venezuela, Informe Económico de 1979, 1981 y 1982.

Fondo de Crédito Agropecuario, Oficina de Planificación.

Table 8. Venezuela Production of Major Carbohydrates, 1960-85.

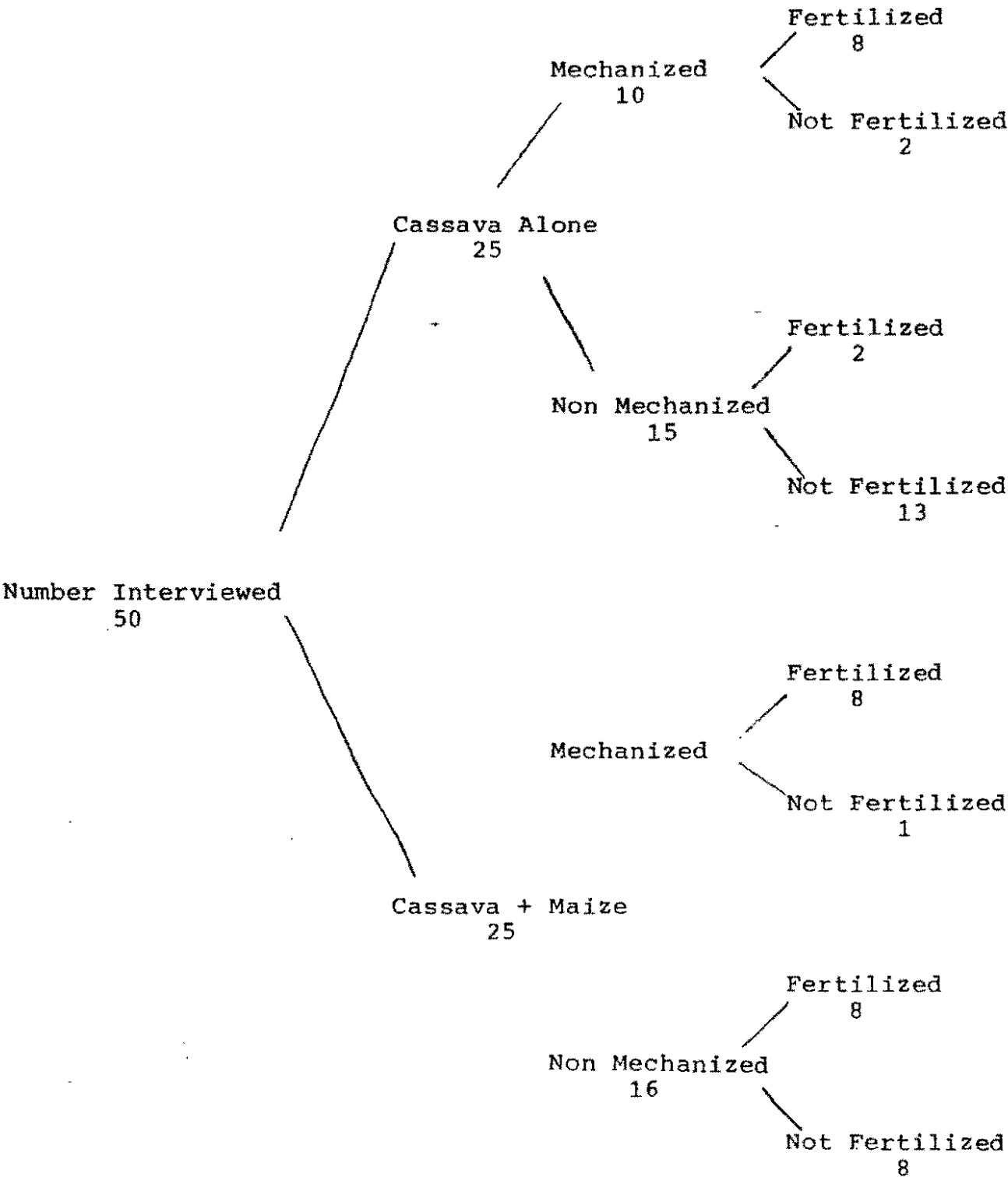
Año	=====		Produccion		=====	
	Yuca	Papa	Arroz	Maiz	Trigo	Platano
	TM	TM	TM	TM	TM	TM
1960	340	134	72	439	1	296
1961	300	74	81	420	1	301
1962	323	121	103	540	1	275
1963	342	111	131	430	1	276
1964	312	124	165	475	1	287
1965	301	136	199	521	1	283
1966	320	126	194	557	1	279
1967	316	133	223	633	2	259
1968	341	143	244	661	1	293
1969	310	124	244	670	1	342
1970	317	125	226	710	1	370
1971	323	115	153	713	1	377
1972	318	109	164	506	1	372
1973	272	124	302	454	1	369
1974	293	152	297	554	1	382
1975	317	152	363	653	1	370
1976	295	132	206	417	1	363
1977	304	179	496	774	1	406
1978	304	171	502	591	1	445
1979	315	191	614	612	0	437
1980	312	199	619	575	0	418
1981	327	171	681	452	0	426
1982	301	217	609	501	0	413
1983	325	225	449	488	0	420
1984	331	226	409	609	1	438
1985	310	191	472	900	1	445

TABLE 9

Venezuela.- Cassava Production By State, 1,983.-

	Has.	Tons.	Prod.Per Cap.
Eastern			
Bolivar	5,482	52,740	72.4
Sucre	2,016	21,402	34.5
Monagas	3,987	42,313	99.3
Anzoategui	4,270	30,960	41.1
Central and C. West			
Carabobo	2,409	10,104	9.1
Cojedes	2,801	21,317	143.9
Guarico	853	7,536	18.6
Falcon	144	546	1.0
Lara	278	2,100	1.8
Portuguesa	566	2,611	5.5
Apure	1,148	7,475	34.8
Miranda	2,012	24,408	16.2
Andes and Western			
Barinas	1,600	12,800	36.8
Merida	1,976	14,812	29.2
Trujillo	917	4,680	8.5
Tachira	2,128	14,943	20.1
Zulia	7,825	52,977	28.8
323724	40,412	323,724	26.8
Totals for the Country	40,526	324,733	20.4
Summary of Production.-			
Eastern		147,415	45.5%
Central and C. West		76,097	23.5%
Andes and Western		100,212	31.0%

Table 10. Characterization of the Sample of Cassava Producers, Monagas, 1986.



Average Cassava Lot : 3.5 Has.

Average Farm Lot : 14.8 Has.

TABLE 10A

YUCA
OFERTA Y DEMANDA
(Ton.)

1	2	3	4	5	6	7
Años	Oferta Producción Nacional	Intermedia (Almidón)	D E M A N D A		Consumo Directo	Demanda Total
			Alimentación Animal	Producción de Casabe		
1960	340.248	6.450	131.988	40.518	161.292	340.248
1961	339.223	14.310	131.855	40.131	152.927	339.223
1962	322.805	22.434	123.921	39.741	136.709	322.805
1963	342.388	21.558	134.237	39.354	147.239	342.388
1964	311.697	16.439	119.066	38.964	137.228	311.697
1965	301.423	29.040	114.244	38.557	119.582	301.423
1966	320.000	24.912	124.053	38.187	132.848	320.000
1967	315.563	23.070	122.190	37.800	132.503	315.563
1968	340.882	40.818	132.027	40.800	127.237	340.882
1969	309.847	41.550	119.892	37.200	111.205	309.847
1970	317.197	39.558	122.719	38.100	116.820	317.197
1971	322.724	46.158	124.621	39.000	112.945	322.724
1972	318.170	46.110	122.468	38.100	111.492	318.170
$\bar{X}$	323.244	28.647	124.868	38.958	130.771	324.013

Fuente: Cuadro N° 14 Consumo Aparente.

TABLE 11

V E N E Z U E L A				
1965-84				
Resumen de Tasas de Crecimiento Anual				
Consumo Per Capita		Consumo Per Capita		
Vacuno	1.3%	Yuca	-3.1%	
Cerdos	2.3%	Papa	-0.0%	
Aves	5.9%	Arroz	2.2%	3.1%
		Trigo	0.7%	
Produccion Total de Aves		Maiz	-0.6%	
	8.9%	Platano	-0.8%	Periodo
Precios Reales al Detal		Produccion Total de Yuca		1965
Vacuno	2.2%		0.0%	a
Cerdos	0.7%	Precios Reales al Detal		1980
Aves	-2.4%	Yuca	3.8%	
		Papa	2.6%	
Precio Relativo		Arroz	-0.5%	-2.9%
Vacuno/Aves	4.6%	Trigo	3.0%	
		Maiz	3.3%	
Concentrado Animal	10.4%	Platano	1.6%	
		Precio Relativo		
Imp. Maiz y Sorgo	23.3%	Yuca/Trigo	0.8%	
Poblacion Urbana	4.2%	Ingreso Real PC	1.8%	
Poblacion Total	3.3%	Produce. Sorgo	5.1%	

Table 12. Venezuela, Real Retail Prices of Carbohydrates, and Per Capita Real Income, 1960-1985 (Bs. of 1968).

====###Precios al Detal deflactados por IPC Alimentos####							YDR
Platano	Yuca	Papa	Arroz	Maiz	Trigo	Platano	Per Cap. Defl.
1,960							
1,961							
1,962							
1,963							
1,964							
1,965	\$0.71	\$0.87	\$1.21	\$0.73	\$0.64	\$0.59	\$3.38
1,966	\$0.59	\$1.01	\$1.63	\$0.69	\$0.63	\$0.58	\$3.34
1,967	\$0.61	\$0.97	\$1.62	\$0.71	\$0.63	\$0.58	\$3.37
1,968	\$0.70	\$0.90	\$1.61	\$0.70	\$0.62	\$0.60	\$3.30
1,969	\$0.63	\$1.01	\$1.54	\$0.66	\$0.61	\$0.59	\$3.42
1,970	\$0.60	\$0.90	\$1.44	\$0.66	\$0.67	\$0.49	\$3.62
1,971	\$0.64	\$0.84	\$1.42	\$0.63	\$0.65	\$0.50	\$3.58
1,972	\$0.65	\$0.95	\$1.36	\$0.63	\$0.63	\$0.54	\$3.59
1,973	\$0.63	\$1.04	\$1.34	\$0.76	\$0.61	\$0.54	\$3.69
1,974	\$0.58	\$0.93	\$1.30	\$0.79	\$0.56	\$0.52	\$3.61
1,975	\$0.73	\$0.89	\$1.32	\$0.80	\$0.51	\$0.60	\$4.03
1,976	\$0.79	\$0.87	\$1.17	\$0.89	\$0.63	\$0.65	\$4.55
1,977	\$0.89	\$0.79	\$1.06	\$0.79	\$0.82	\$0.62	\$4.68
1,978	\$0.85	\$0.78	\$1.03	\$0.78	\$1.16	\$0.62	\$4.65
1,979	\$0.94	\$0.89	\$1.02	\$0.90	\$1.29	\$0.61	\$4.97
1,980	\$1.00	\$1.36	\$1.05	\$1.01	\$1.15	\$0.60	\$4.80
1,981	\$0.98	\$1.55	\$1.80	\$1.13	\$1.09	\$0.65	\$4.78
1,982	\$0.91	\$1.12	\$1.50	\$1.02	\$0.91	\$0.64	\$4.65
1,983	\$1.11	\$1.46	\$1.43	\$1.03	\$0.86	\$0.64	\$4.36
1,984	\$1.27	\$1.46	\$1.54	\$1.22	\$0.90	\$0.77	\$4.11
1,985	\$1.44	\$1.67	\$1.45	\$1.45	\$0.85	\$0.85	\$3.97

TABLE 13

Elasticidades de Series de Tiempo para varios Países, 1965-84
Consumo Per Capita de Yuca Fresca

	Colombia	Ecuador	Paraguay	Peru	Venezuela
Precio Propio	-0.43 (3.09)	-2.08 (3.59)	-0.10 (4.62)	-0.21 (3.08)	-0.10 (3.53)
Ingreso	2.51 (1.73)	1.38 (1.89)	-0.13 (7.03)	0.03 (0.13)	0.08 (0.44)
Urbanizacion	-1.55 (3.14)	-0.99 (2.85)	-0.13 (5.52)	-1.03 (9.17)	-0.77 (6.90)
Precio Trigo	ND	0.45 (3.01)	0.07 (5.38)	0.11 (1.84)	0.13 (2.60)
Precio Arroz	0.09 (2.16)	2.42 (2.78)	ND	0.64 (12.24)	0.18 (2.00)

Valores entre parentesis: estadístico t de Student.

Modelo Doble Logaritmico PC-OLS.

Elasticidades de Series de Tiempo para varios Países
Consumo Per Capita de Carne de Aves

	Colombia	Ecuador	Paraguay	Peru	Venezuela
Precio Propio	-0.46 (10.45)	-0.19 (1.73)	-0.33 (6.39)	-1.19 (6.26)	-0.92 (10.39)
Ingreso	0.88 (10.86)	0.57 (8.14)	0.59 (10.73)	0.54 (1.54)	1.09 (14.03)
Precio Vacuno	0.61 -2.54	0.80 (8.88)	-0.15 (3.10)	0.66 (3.75)	0.44 (1.76)
Precio Cerdos	-1.14 (5.60)	0.39 (1.86)	0.53 (6.49)	0.52 (2.36)	-0.70 (2.12)

Valores entre parentesis: estadístico t de Student.

Modelo Doble Logaritmico PC-OLS.

Table 14. Venezuela, Per Capita Consumption of Major Carbohydrates 1960-85.

=====CONSUMO PER CAPITA DE CARBOHIDRATOS =====

Ano	Yuca	Papa	Arroz Paddy	Maiz	Trigo	Platano
1960	42.3	16.7	7.5	32.3	36.9	36.8
1961	35.9	8.9	9.0	33.5	37.2	36.0
1962	37.2	13.9	11.4	39.9	30.5	31.7
1963	37.9	12.3	14.5	31.6	34.0	30.6
1964	33.3	13.2	17.6	48.3	45.4	30.6
1965	30.9	13.9	22.5	39.9	43.2	29.0
1966	31.6	12.5	24.1	38.4	42.2	27.6
1967	30.1	12.7	27.2	41.8	52.6	24.7
1968	31.3	13.1	25.4	57.6	54.8	26.9
1969	27.5	11.0	22.4	45.0	50.7	30.3
1970	27.2	10.7	24.4	48.5	48.9	31.7
1971	26.8	9.5	12.7	51.6	46.2	31.3
1972	25.6	8.8	13.2	45.5	48.3	29.9
1973	21.2	9.7	23.7	51.4	42.6	28.8
1974	22.2	11.5	27.5	53.3	40.9	28.9
1975	23.3	11.2	29.1	51.5	46.4	27.1
1976	21.0	9.4	14.7	37.0	50.8	25.8
1977	21.0	12.3	34.2	53.4	48.7	28.0
1978	20.3	11.4	33.6	45.3	54.0	29.8
1979	20.4	12.4	40.4	42.2	45.9	28.3
1980	19.6	12.5	40.0	50.5	48.7	26.3
1981	19.9	10.4	41.5	56.2	53.9	25.9
1982	18.0	13.0	36.5	50.6	46.3	24.7
1983	18.8	13.0	26.0	41.0	48.3	24.3
1984	18.6	12.7	22.9	35.9	60.9	24.6
1985	16.9	10.4	25.7	29.4	56.8	24.2

Table 15 Projections for Time Series Model for the year 2000 Venezuela.

DRIED CASSAVA

Annual Rates of Growth

Per Capita Real Income	1.0
Population	2.8%
Real Retail Price Poultry	-1.0%
Real Retail Price Pork	-1.0%
Sorghum Production	4.0%

VARIABLES LEVELS

	1984	2000
Population	17.8	28.3
Per Capita Consumption of:		
Beef	19.1	
Pork	6.4	7.9
Poultry	16.9	25.2
Pork Meat Production	114.5	223.0
Poultry Meat Production	290.2	784.9
Total Feed Production	2,955.5	5,736.6
Pork Feed Production	956.1	1,783.7
Poultry Feed Production	1,744.4	3,204.6
Maize/Sorghum		
Implicit Use	1,921.4	3,728.8
Imports	1,300.0	2,012.6

DRIED CASSAVA

Percent in Feed	10.0%	
Required Production		573.7
Maize/Sorghum Imports		1,438.9
Foreign Exchange Earnings (Mill. US\$)		\$57.4
Fresh/Dried Cassava Conversion		2.5
Cassava Yield/Hectare		10.0
Fresh Cassava Labor/ha		45.0
Dried Cassava Labor/ton		3.0
Fresh Cassava Required, 1000 tons		1,380.0
Required Hectares		137,996
New Jobs Generated		34,545.6

FRESH CASSAVA

Annual Rates of Growth

Per Capita Real Income	1.0%
Population	2.8%
Real Retail Price Fresh Cassava	-1.0%

VARIABLE LEVELS

	1984	2000
Population	17.8	28.3
Per Capita Consumption of		
Fresh Cassava	18.6	19.1
Fresh Cassava Production	331.0	541.8
Production Increase (1000 tons)		156.8
Additional Hectares for Cassava		15,680.0
New Jobs Generated		3,763.0

FINAL BALANCE FOR FRESH AND
DRIED CASSAVA

Additional Production for		
Fresh Cassava (1000)		1,536.8
Required Hectares		153,676.0
New Jobs Generated		34,545.0

le 16. Profitability of a Cassava Drying Floor, Monagas. 1986.

udio de Factibilidad para Planta de Secado Natural de Yuca.

Superficie de la planta(Mts.Cuadrados):	1,000
Meses de Operacion(Meses/Año):	4
Capacidad de Secado(Kgs./Mt.Cuadrado):	12
Costo de Yuca Seca \$/ton:	\$2,010
Costo de Mano de Obra (\$/dia):	\$50
Factor de Conversion Fresca/seca:	2.5
Consumo de Yuca Fresca/Ha. (Kgs.):	12,500
Costos de transporte yuca seca(\$/ton):	\$100
Costo de sorgo (\$/ton):	\$2,513

Tasa Interna Calculada:	15.0%	*
Valor Presente Neto (10%):	\$95,391	*

Capacidad Anual, Yuca Fresca (Kgs.):	576,000
Equivalente en Hectareas/año	46.1

Valor Real

INVERSIONES	Unitario	Unidades	Pesos de 1985
Costo	\$60	1000	\$60,000
Costo de Picado	\$100	32	\$3,200
Costo de Almacenamiento	\$160	336	\$260,000
Costo de Mano de Obra	\$15	240	\$45,000

\$368,200

EQUIPOS

Mozadora	\$10,000	1	\$10,000
Motor con acople	\$15,000	1	\$15,000
Bascula (500 kg.)	\$1,500	1	\$1,500

\$26,500

HERRAMIENTAS

Arretillas	\$350	6	\$12,000
Alas	\$28	12	\$3,000
Destrillos	\$15	4	\$4,000
Recogedores	\$50	4	\$4,000
Paquetes	\$3.50	200	\$20,000
Carpa Plastica	\$3	500	\$40,000

\$83,000

S T O T A L

\$477,700

Revisitos 5%			\$23,885
Costo de Trabajo	\$30	1400	\$42,000

\$543,585

TABLE 17

Distribution of Direct Costs for Cassava (Fresh and Dried)
and for Sorghum, Monagas, Venezuela, 1986.

	Drying Costs		Drying and Raw material		
	Total Bs./ha	Cost per Ton. Bs./ton	Cost per Ton Bs./ton	Free Mkt 20 US\$/ton	Official 7.5
Land	\$8.33	\$0.04	\$2.54	\$0.13	\$0.34
Labor	\$47,455.67	\$206.02	\$592.27	\$29.61	\$78.97
Capital	\$59,371.12	\$257.69	\$760.69	\$38.03	\$101.42
Total	106946.12	\$463.74	\$1,355.49	\$67.77	\$180.73
Rendimiento Yuca Fresca:			\$12,500		
Farm Gate Price, 85% Sorghum			\$1,870		
Gross Margin			\$515		

Costos de Produccion de Sorgo, Monagas.-1,986

Rendimiento: 2.5 tons/ha

	Total +20%		Cost/ton		Cost in US Dollars	
			Bs/ton	Free Rate	Official 7.5	
Mechanization	1228.464					
Inputs	1058.28					
Labor	288					
	Total					
Land	\$20.83	\$8.33	\$0.42	\$1.11		
Labor	\$288.00	\$115.20	\$5.76	\$15.36		
Capital	\$2,286.74	\$914.70	\$45.73	\$121.96		
Total	\$2,595.58	\$1,038.23	\$51.91	\$138.43		
Farm Gate Price	\$2,200		\$110.00	\$293.33		
Gross Margin	\$1,162		\$58.09	\$154.90		

REFERENCES

Venezuela

1. UCV, Agronomia, editors. Seminario Nacional de Yuca. Trabajos del Grupo Interdisciplinario sobre Yuca Maracay, 1980.
2. Hernandez, IJ.L. Evaluación de los Efectos de la Política Oficial sobre la Agricultura. Conclusiones de las Mesas de Trabajo. 5 Documentos. Caracas, 1985.
3. Interamerican Development Bank. Venezuela, Informe de Proyecto. Fondo de Crédito Agropecuario. 1984. Not for Public Use.
4. Interamerican Development Bank. Economic and Social Progress in Latin America, 1986. Washington, D.C.
5. Banco Central de Venezuela. Estudio Integral de la Agricultura en Venezuela. Raíces y Tubérculos. Caracas, 1974.
6. UCV, Ciencias Económicas y Sociales. El Circuito Agroalimentario del Trigo. Importaciones, Precios y Producción Industrial. Caracas, 1986.
7. USDA. Grain and Feed Annual Report, Agricultural Attache, U.S. Embassy, Caracas, Several Issues.
8. Wright, E.W. The Political Economy of Venezuelan Food Policy 1958-1978. Ph.D. Thesis. University of Maryland. 1982.

9. Rivas, L.; Sanint, L.R.; Sere, C.; Cordeu, J.L. El Sector Carnes en Latinoamerica. Proyecto FAO/CIAT. To be published, 1985.
10. MAC. Anuario Estadístico Agropecuario. 1982-83. Caracas, 1985.
11. Hernández, J.L. El Sistema Agroalimentario en el Contexto Económico: los determinantes del mercado futuro de cereales en Venezuela. In: Simposio IESA. La Comercialización de Cereales en Venezuela. 23-24 Mayo 1986. Caracas.
12. World Bank. The Economic Development of Venezuela, Baltimore, 1961.
13. Jaffé, W.; Rothman, H. An Implicit Food Policy: Wheat Consumption Changes in Venezuela. Food Policy, Nov. 1977.
14. Latin America Weekly Report. Sept. 13, 1985. WR-85-36.

