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Trends and Prospects for Cassava in the Philippines

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TRENDS AND PROSPECTS FOR CASSAVA IN THE PHILIPPINES

by

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FOREWORD

Cassava is a staple food crop cultivated in several developing countries, largely by small farmers. It is a source of subsistence and of cash income for poor farmers as well as a source of rural employment, particularly of women. During the past 20 years, production of cassava has expanded rapidly in Asia, particularly in Thailand in response to expanded demand for its import in the European Community, where it is used as livestock feed. There are concerns, however, about the likely decline in demand for cassava as food as incomes rise in developing countries and also about the stability of the European demand. To assess the prospects for cassava in the future, IFPRI has examined the trends and prospects for production, utilization, and trade of cassava in Third World countries under a special project partially funded by the International Development Research Centre (IDRC) of Canada.

In addition to the analysis of international data at the global and regional levels, case studies were taken up in six countries: India, Indonesia, the Philippines, and Thailand in Asia and Nigeria and Zaire in Sub-Saharan Africa. The results of these studies were discussed at a workshop in Washington, D.C. in August 1987, where project researchers, selected cassava scientists, and representatives of international organizations participated. The report on the proceedings of the workshop will be published separately. The results of the individual case studies are being published as a series of working papers. *Trends and Prospects for Cassava in the Philippines*, by Liborio Cabanilla, is the second in the series.

J. S. Sarma

1. INTRODUCTION

The Philippine agricultural sector has been undergoing important structural changes in the past decade due to both domestic and international factors. Traditional export crops, especially sugar, have faced unfavorable world market conditions so that land devoted to these crops is slowly being planted to other crops, particularly corn. Most recently, coconut oil has faced serious potential trade restrictions in its traditional markets. This has led to moves to encourage multi-story cropping systems in an effort to increase production and income potential of coconut-cropped land.

The domestic terms of trade, although historically unfavorable to agriculture, are expected to change because of tremendous pressure to remove biases against agriculture. Massive rural employment programs and the planned increase in public investments in rural infrastructure will boost rural incomes, and, therefore, purchasing power.

These and other factors will surely affect the product mix in agriculture in the future. Although rice and corn will continue to be the two most important crops in terms of hectarage and output for food security reasons, the contribution of some crops to value added will decline, while others are expected to become significant sources of growth in agriculture. Nontraditional export commodities such as fruits will play significant roles. The performance of other food crops, by virtue of their poor income elasticities of demand, will largely depend on the demand for them for nonfood uses in the industrial sector. The greatest potential demand for cassava in industry is in the form of starch and animal feeds. Barring any increase in protectionism in the importing countries, cassava also has good international market potential.

This study analyzes the past trends in cassava production and consumption in the Philippines. Based on this analysis, future prospects are assessed and some policy recommendations to improve cassava's prospects are suggested.

Data problems in the study should be pointed out at the outset. For example, the wide variations in area and yield in published and unpublished data from the Bureau of Agricultural Economics (BAEcon) are hard to explain. Cassava utilization data in the food balance sheets of the National Economic Development Authority (NEDA) are likewise inconsistent with food consumption surveys conducted by the Food and Nutrition Research Institute (FNRI). Adjustments were made to smooth out the abnormal yearly variations in area and yield. In

addition, domestic utilization data, particularly on food use, were adjusted in an attempt to make the estimates in this paper close to those suggested in the food consumption surveys.

Cassava contributes a minuscule amount to total agricultural production. In 1983, the total value of cassava output was only 4 percent of total agricultural output. This is primarily because cassava, regarded as a subsistence crop, is generally planted in marginal areas where other food crops do not thrive.

It occupies 2 percent of the total food crop area and 38 percent of the total root crop area (Tables 1 and 2). Most cassava is produced in regions where few crops compete for the available arable lands. Because its income elasticity of demand for food is low, cassava is mostly planted in the poorer regions of the country (Table 3).

Yields are still low, an average of 6.8 tons per hectare in 1983, or an average of about 9.4 tons during 1980-82 (Table 4).[1] This is primarily because the application of fertilizer is low except where farmers cultivate cassava under contract with starch manufacturers.

There are 11 starch manufacturing plants in the country today. Under the contract growing system, the starch companies extend a loan to the farmers in the form of physical inputs like fertilizer and chemicals and buy the fresh roots at a preset price. A sample contract is presented in Appendix 1. Since the loan is extended not in monetary form but as physical inputs, contract farmers are forced to apply fertilizer, which means that their productivity is higher than the national average. Most ordinary farmers do not apply fertilizer. As a result, varieties with high potential yields of 40-50 tons per hectare only yield about one-sixth of that potential. Historically, cassava is used mostly for human food and for the manufacture of starch and livestock feeds. The sweet type (Lakan 1) is planted for home consumption, while the bitter types (Datu 1 and Sultan 1) are planted for industrial use. Generally, the bitter varieties give higher yields than the sweet varieties. (Datu 1 yields 42 tons per hectare; Sultan 1 yields 56 tons per hectare.)

Despite the establishment of the Root Crops Research Center at the Visayas State College of Agriculture (VISCA) in the province of Leyte in 1975, few research funds have been devoted to root crops. From 1974 to 1984, the annual research fund allocation to cassava equaled 0.33 percent of the value of cassava produced. In absolute terms, this is quite small. It is even glaringly small when compared to other crops (Table 5). To a casual observer, this implies that there are high marginal returns to research and suggests that there is a need for increasing research support for cassava not only in its agronomic but also its socioeconomic aspects.

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[1]In this report, all tons are metric tons.

Table 1--Area harvested and production of food crops, crop years 1982 and 1983

Food Crops	1982 Area	1982 Share of Total	1982 Production	1982 Share of Total	1983 Area	1983 Share of Total	1983 Production	1983 Share of Total
	(1,000 hectares)	(percent)	(percent)	(1,000 hectares)	(1,000 hectares)	(percent)	(1,000 metric tons)	(percent)
Root crops[a]	480	5.82	3,174	14.26	423	5.57	2,102	10.32
Cassava	176	2.13	1,581	7.10	174	2.25	1,183	5.81
Vegetables[b]	69	0.84	516	2.32	65	0.84	449	2.20
Palay (rough rice)	3,443	41.75	8,122	36.49	3,240	41.92	7,730	37.94
Corn	3,361	40.76	3,290	14.78	3,158	40.86	3,126	15.34
Banana	331	4.01	4,078	18.32	326	4.22	3,886	19.07
Mango	41	0.50	426	1.91	42	0.54	373	1.83
Pineapple	60	0.73	1,242	5.58	62	0.80	1,683	8.26
Other fruits and nuts[c]	74	0.90	578	2.60	65	0.84	334	1.64
Citrus[d]	26	0.32	133	0.60	26	0.34	130	0.64
Beans and peas[e]	69	0.84	50	0.22	47	0.61	37	0.18
Coffee	136	1.65	171	0.77	137	1.77	147	0.72
Cacao	11	0.13	5	0.02	11	0.14	6	0.03
Peanuts	57	0.69	49	0.22	48	0.62	36	0.18
Other food crops	88	1.06	425	1.91	79	1.03	335	1.64
Total	8,246	100	22,259	100	7,729	100	20,374	100

Source: National Economics and Development Authority, Philippine Statistical Yearbook 1986 (Manila, NEDA, 1986).

[a]Root crops include camote, gabi, pao (gialiang), tuqui, and ubi.

[b]Vegetables include cabbages, eggplants, garlic, pechay, radishes, tomatoes, and ginger.

[c]Fruits and nuts include atis, avocado, caimito, cashews, chico, guayabano, jackfruit, lanzones, papayas, pili, grapes, and watermelons.

[d]Citrus includes calamansi, mandarins, oranges, and pomelo.

[e]Beans and peas include drybeans, mongo, and soybeans.

Table 2--Area harvested and production of roots and tubers, average for crop years 1980 to 1983

Crop	Area	Share of Total	Production	Share of Total
	(1,000 hectares)	(percent)	(1,000 metric tons)	(percent)
Cassava (Manihot esculenta)	170	38.55	1,481	54.97
Camote (Ipomea batatas)	222	50.34	1,032	38.31
Gabi (Colacassia esculenta)	33	7.48	109	4.05
Pao (Cyrtosperma chamissini)	3	0.68	12	0.44
Tugui (Dioscorea esculenta	1	0.23	5	0.18
Ubi (Dioscorea alata)	8	1.81	17	0.63
White potatoes (Solanum tuberosum)	4	0.91	38	1.42
Total	441	100.00	2,694	100.00

Source: Philippines, Bureau of Agricultural Economics, unpublished data.

Table 3--Per capita gross domestic product and the share of cassava area in total cultivated area, by region, 1984

Region	Gross Regional Product Per Capita (at current prices)	Share of Area Planted with Cassava in Total Cultivated Area
	(₱)	(percent)
Ilocos	5,549	0.40
Cagayan Valley	6,169	0.08
Central Luzon	9,945	0.23
Southern Tagalog	11,885	0.54
Bicol	4,550	2.86
Western Visayas	8,501	0.87
Central Visayas	9,075	3.83
Eastern Visayas	3,857	3.32
Western Mindanao	6,752	4.10
Northern Mindanao	8,504	1.93
Southern Mindanao	10,125	0.42
Central Mindanao	7,910	2.44
Philippines	10,111	1.76

Source: National Economic and Development Authority, Philippine Statistical Yearbook 1987 (Manila: NEDA, 1987).

Table 4--Yields of root crops and foodgrains, averages for crop years 1980 to 1982 and 1983 to 1985

Crop	1980-82	1983-85
	(metric tons/hectare)	
Root crops		
Cassava	9.39	6.80[a]
Camote	4.66	4.71
Gabi	3.30	3.21
Pao	3.63	3.45
Tugui	4.96	5.66
Ubi	2.29	2.39
Irish potatoes	9.67	9.99
Foodgrains		
Palay (rough rice)	2.25	2.48
Corn (shelled)	0.97	1.02
Soybeans	1.00	0.98
Mongo	0.65	0.74
Dry beans and others	0.76	0.85

Source: Philippines, Bureau of Agricultural Economics, unpublished data

[a]This figure is for 1983 alone.

Table 5--Research expenditure on foodcrops, 1984

Crop	Amount	Share of Total
	(₱)	(percent)
Root crops[a]	7,454,106	22.56
Cassava	1,448,430	4.38
Corn and sorghum	4,689,944	14.19
Legumes	4,443,345	13.45
Rice and other cereals	4,195,218	12.70
Sugarcane	3,959,000	11.98
Vegetables	3,814,515	11.54
Fruit crops	3,038,162	9.20
Total	33,042,720	100.00

Source: Philippine Council for Agriculture and Resources Research and Development (PCARRD), unpublished data.

Note: These figures include on-going research projects and research proposals whose funding has been approved and that are being monitored by the PCARRD.

[a]This does not include cassava.

Unlike other Asian countries, such as Thailand and Indonesia, the Philippine cassava industry is largely geared toward satisfying the limited domestic market. The rural infrastructure and other handling facilities to encourage expansion of cassava production for export to the world market have not been developed. There is also a serious lack of other support services such as credit facilities. More importantly, because land frontiers have been closed since the early 1970s, expansion of production means that cassava will have to compete with other crops for available arable land. Lack of appropriate incentives and a failure to make drastic improvements in farm productivity may prove to be the main constraints to the future potential of cassava in the Philippines. Extension workers also lament a shortage of planting materials of high-yielding varieties.

2. TRENDS IN CASSAVA PRODUCTION, UTILIZATION, TRADE, AND PRICES

TRENDS IN AREA, PRODUCTION, AND YIELD

Production data shown in Table 6 indicate that cassava output more than doubled between 1961 and 1983. It appears, however, that during the 1960s production was stagnant, increasing only during the 1970s and 1980s. These increases were due primarily to area expansion; yield per hectare remained practically the same until the 1970s. A perceptible increase in yields occurred only in the late 1970s (see Table 6 and Figure 1), a reflection of the effects of high-yielding varieties.

Production dropped in 1983 due to severe drought, but the latest data indicate that it is picking up again, approaching the growth rate of the mid-1970s. The share of the area planted with cassava in the area planted with all crops increased during the 1961-83 period (Figure 1), although there is not enough evidence to show that increases in the area devoted to cassava came at the expense of the area devoted to other crops (Table 7). It is worth noting, however, that in some major cassava-producing regions of the country, some increases in the area planted with cassava relative to the other crops are observable (Figure 2).

TRENDS IN DOMESTIC UTILIZATION

Between 1961 and 1983, 55 percent of total production was used for human food, 28 percent for manufactures, and 17 percent for feeds. This distribution was fairly stable, although slight changes were noticeable. As expected, food use generally declined, except for some years of rice shortage. Cassava utilization in the manufacturing sector (starch and flour) shows a distinct trend. From 1961 to 1971, an average of 21 percent of total production was used to manufacture starch and flour, but this increased to an average of 36 percent in 1972-83, coinciding with the decline in starch imports. In 1983, when the manufacturing sector of the country began to falter, starch production dropped significantly (see Table 8). It is worth noting, however, that cassava starch and flour manufacturing registered an average growth rate of 12.8 percent per year from 1961-63 to 1981-83.

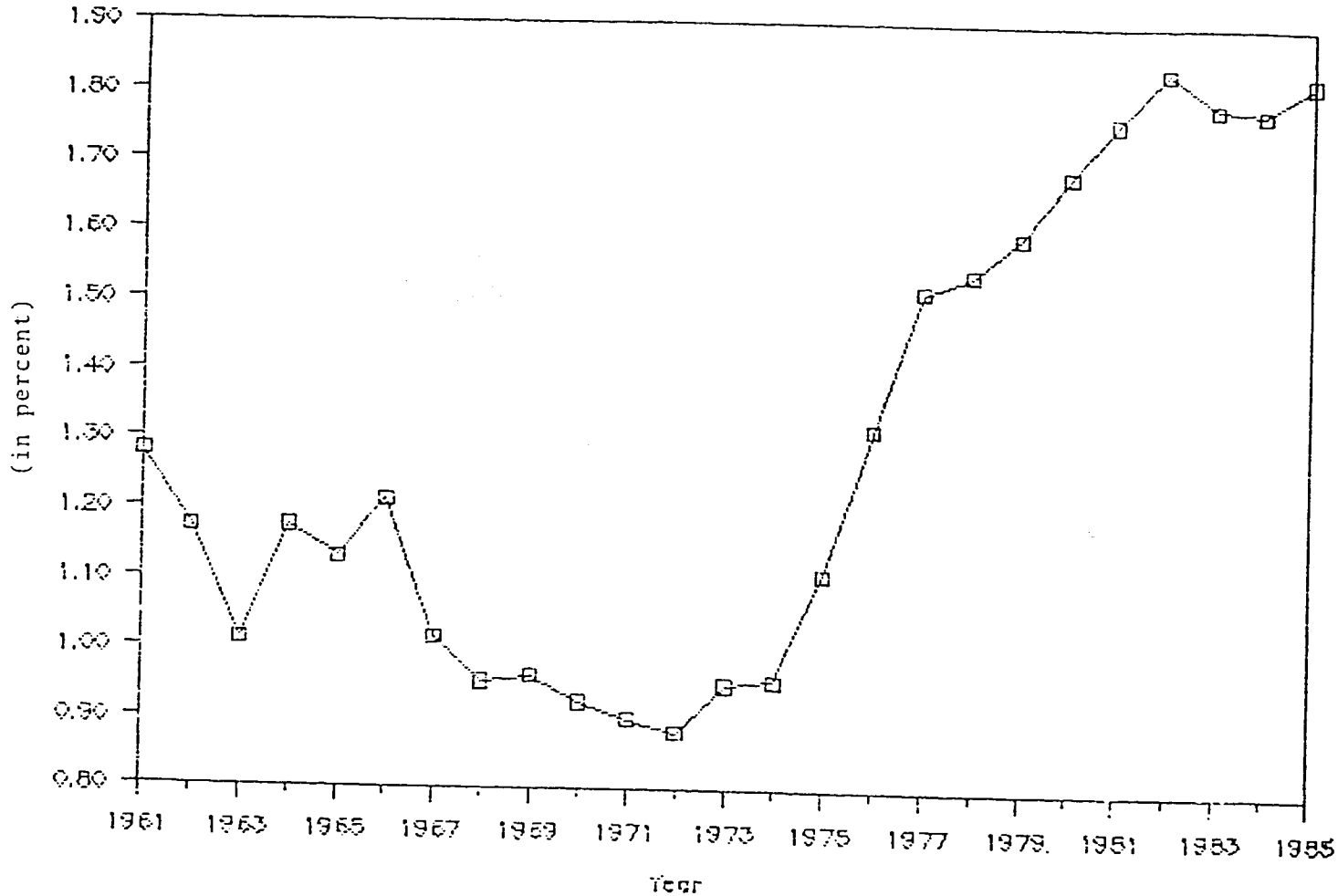
Table 6--Area harvested, production, and yield of cassava, 1961-83

Year	Area	Production	Yield
	(hectares)	(metric tons)	(metric tons hectare)
1961	88,885	494,512	5.50
1962	96,645	520,708	5.39
1963	86,630	476,287	5.50
1964	86,910	526,963	6.06
1965	93,410	620,938	6.65
1966	91,490	630,053	6.89
1967	88,110	571,557	6.49
1968	85,200	505,328	5.93
1969	84,785	484,628	5.72
1970	84,155	464,775	5.52
1971	82,200	434,639	5.29
1972	82,250	435,077	5.29
1973	85,050	448,074	5.27
1974	92,065	471,508	5.12
1975	101,272	559,021	5.52
1976	116,463	770,985	6.62
1977	133,932	1,058,063	7.90
1978	147,325	1,244,896	8.45
1979	153,218	1,424,927	9.30
1980	160,879	1,568,570	9.75
1981	168,923	1,589,565	9.41
1982	175,680	1,581,120	9.00
1983	173,923	1,182,676	6.80

Source: Philippines, Bureau of Agricultural Economics, unpublished data.

Note: The data for 1961-74 are given as shown by the Bureau of Agricultural Economics. However, the data for the succeeding years have been adjusted on the basis of the observed trend because of erratic movements shown in the original data.

Figure 1--Share of cassava in total cultivated area, 1961-83



Source: Philippines, Bureau of Agricultural Economics, unpublished data.

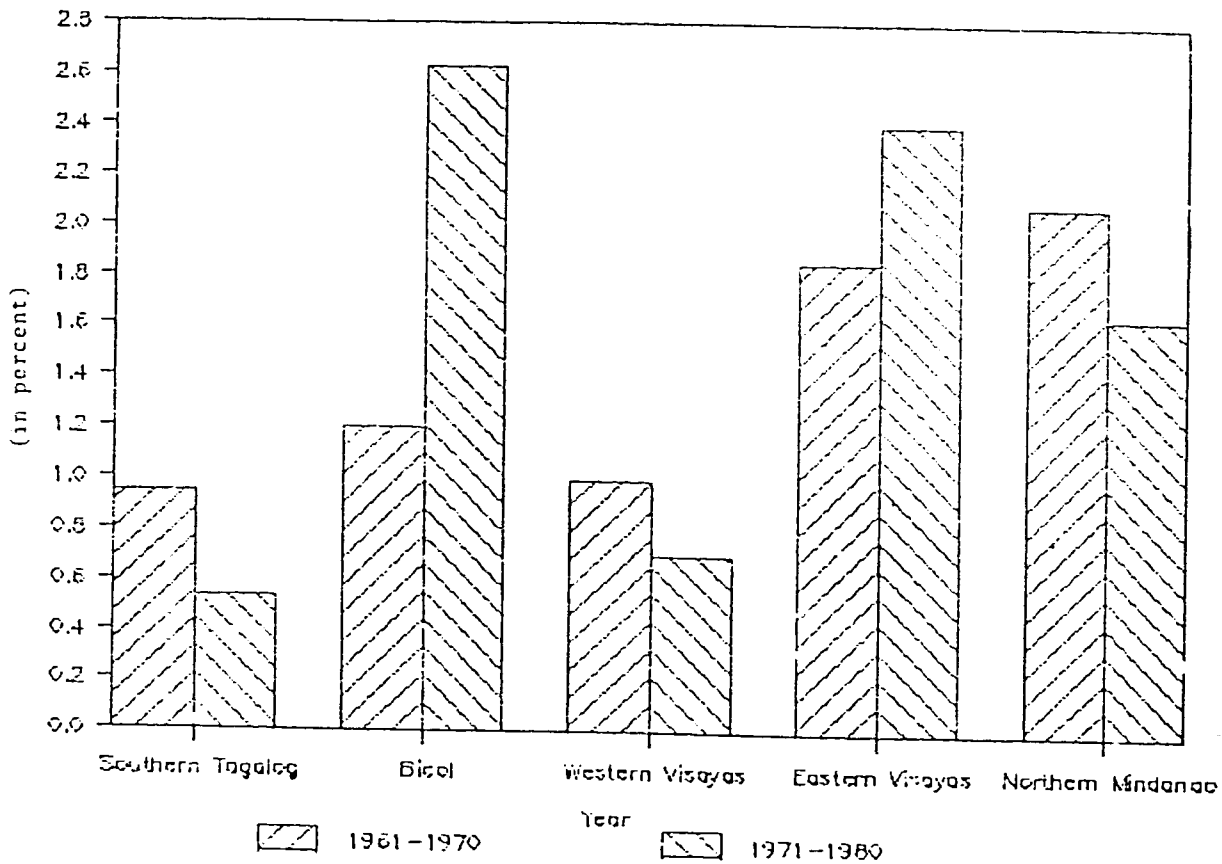
Table 7--Distribution of cultivated area among crops, 1980-83

Crop	1980		1981		1982		1983	
	Area	Share of Total	Area	Share of Total	Area	Share of Total	Area	Share of Total
Food crops	8,222.1	67.70	8,080.7	66.80	8,249.3	66.40	7,729.5	66.50
Cassava	160.9	1.32	168.9	1.40	175.7	1.41	173.9	1.50
Palay	3,636.8	29.97	3,459.1	28.92	3,442.8	28.18	3,239.6	27.83
Corn	3,201.1	26.38	3,238.7	27.08	3,360.7	27.51	3,157.5	27.13
Banana	317.6	2.62	311.8	2.61	331.4	2.71	326.0	2.80
Mango	39.2	0.32	42.4	0.35	41.3	0.34	42.5	0.36
Pineapple	62.7	0.52	67.0	0.56	60.1	0.49	62.0	0.53
Other fruit and nuts[a]	71.7	0.59	72.6	0.61	77.4	0.63	65.1	0.56
Citrus[b]	24.9	0.21	25.2	0.21	25.8	0.21	25.6	0.22
Other root crops[c]	325.4	2.68	307.7	2.54	304.0	2.45	249.4	2.15
Vegetables[d]	68.8	0.57	66.5	0.56	69.3	0.57	65.2	0.56
Beans and peas[e]	66.5	0.55	68.6	0.57	69.4	0.57	47.3	0.41
Coffee	101.8	0.84	118.7	0.99	135.7	1.11	137.3	1.18
Cacao	4.7	0.04	7.4	0.06	10.9	0.09	11.3	0.97
Peanuts	55.1	0.45	38.7	0.32	56.5	0.46	47.9	0.41
Other food crops	84.9	0.70	87.4	0.73	88.3	0.72	78.9	0.68
Commercial crops	3,915.6	32.30	3,999.0	33.20	4,179.0	33.60	43,891.5	33.50
Coconuts[f]	3,125.9	26.38	3,238.7	27.08	3,360.7	27.51	3,157.5	27.13
Sugarcane[g]	424.6	3.50	421.1	3.52	470.8	3.85	423.6	3.64
Abaca	235.9		230.1	1.92	206.8	1.69	170.3	1.46
Native tobacco	36.7	0.30	32.6	0.27	33.2	0.27	24.6	0.21
Virginia tobacco	24.4	0.20	22.6	0.19	23.9	0.20	28.9	0.25
Rubber	54.1	0.45	53.9	0.45	56.9	0.46	64.2	0.55
Other commercial crops[h]	14.0	0.12	21.9	0.18	26.7	0.22	22.4	0.19
Total	12,137.7	100.00	12,101.6	100.00	12,428.3	100.00	11,621.0	100.00

Source: Philippines, Bureau of Agricultural Economics, unpublished data.

[a]Other fruits and nuts include atis, avocado, caimito, cashews, chico, guayabano, jackfruit, lanzones, papayas, pili, grapes, watermelons.
[b]Citrus includes calamansi, mandarins, oranges, and pomelo.
[c]Other root crops include camote, gabi, pao (gialiang), tugui, and ubi.
[d]Vegetables include cabbages, eggplants, garlic, pechay, radishes, tomatoes, and ginger.
[e]Beans and peas include drybeans, mongo, and soybeans.
[f]Coconuts include nuts used in making copra, dessicated coconuts, nuts used to make homemade oil, nuts used in commercial manufacturing , and nuts eaten as food.
[g]Sugarcane includes cane used for centrifugal sugar, muscovado, panocha, and molasses.
[h]Other commercial crops include castor beans, kapok and seeded cotton, ramie, and maguey.

Figure 2--Share of cassava in total cultivated area, in selected regions, 1961-70 and 1971-80



Source: Philippines, Bureau of Agricultural Economics, unpublished data.

Table 8--Trends in domestic utilization of cassava, 1961-83

Year	Production	Imports	Exports	Total Available Supply	Domestic Use: Food	Share of Total	Feed	Share of Total	Manufac[illegible]	Share of Total
	(metric tons)				(metric tons)				(metric tons)	
1961	494,512	...	...	494,512	377,034	76.2	55,293	11.2	62,185	12.6
1962	520,708	...	...	520,708	385,575	74.0	59,137	11.4	75,996	14.6
1963	476,287	...	...	476,287	381,030	80.0	55,134	11.6	40,123	8.4
1964	526,963	235	...	527,198	425,976	80.8	58,531	11.1	42,691	8.1
1965	620,938	16	1,035	619,919	388,278	62.6	62,252	10.0	169,389	27.4
1966	630,053	791	452	630,392	371,145	58.9	65,6[illegible]2	10.4	193,625	30.7
1967	571,557	20,191	0	591,748	347,447	58.7	62,131	10.5	182,167	30.8
1968	505,328	6,667	0	511,995	337,631	65.9	60,446	11.8	113,916	22.3
1969	484,628	1,697	2	486,323	328,286	67.5	60,255	12.4	97,782	20.1
1970	464,775	54	107	464,722	269,744	58.0	73,987	15.9	120,991	26.1
1971	434,639	2,246	2	436,883	229,295	52.5	78,543	18.0	129,045	29.5
1972	435,077	20,677	3	455,751	278,913	61.2	81,545	17.9	95,293	20.9
1973	448,07[illegible]	12,282	1	460,355	328,913	71.4	69,053	15.0	62,389	13.6
1974	471,508	23,497	0	495,005	338,363	68.4	82,481	16.7	74,161	14.9
1975	559,021	23,340	2	582,359	383,661	65.9	122,252	21.0	76,446	13.1
1976	770,985	11,131	8	782,108	406,658	52.0	139,590	17.8	235,860	30.2
1977	1,058,063	26	1,709	1,056,380	412,996	39.1	196,699	18.6	446,685	42.3
1978	1,244,896	16	368	1,244,544	425,482	34.2	279,610	22.5	539,452	43.3
1979	1,424,927	26	847	1,424,106	422,060	29.6	311,088	21.8	690,958	48.6
1980	1,568,570	24	579	1,568,015	419,727	26.8	331,916	21.2	816,372	52.0
1981	1,589,565	2,542	333	1,591,774	417,285	26.2	336,641	21.1	837,848	52.7
1982	1,581,120	1,949	1,158	1,581,911	416,362	26.3	387,056	24.5	778,493	49.2
1983	1,182,676	19	9,281	1,173,414	413,153	35.2	391,030	33.3	369,231	31.5

Sources: The production data are from the Philippines, Bureau of Agricultural Economics, unpublished data. The data for imports and exports are from the Philippines, National Census and Statistics Office, Foreign Trade Statistics (Manila: NCSO, various issues). The data for domestic food use are from the National Economic and Development Authority, Food Balance Sheets (Manila: NEDA, various issues) and Integrated Agricultural Production and Marketing Projects, Ministry of Agriculture, Philippine Food and Agricultural Development for the 1980s (Manila: IAPMP, 1981). They include adjustments for some years (NEDA, Food Balance Sheets, various issues).

Notes: All figures are in fresh root equivalents. The production data for 1961-74 are given as shown by the Bureau of Agricultural Economics. However, the production data for the succeeding years have been adjusted on the basis of the observed trend because of erratic movements shown in the original data. The figures for feed use were calculated using as a number of substitution ratios of cassava to corn in feed requirements of hogs and poultry. The ration for 1961-74 was 2 percent; for 1975 it was 4 percent; for 1976 it was 5 percent; for 1977 it was 7 percent; for 1978 it was 8 percent; for 1979 it was 9 percent; and it was 10 percent for the years from 1980 on.

Cassava use for feeds was, on the average, 17 percent of total production during 1961-83. Its rate of growth, almost 10 percent per year, seems to be consistent with the trend in the cassava-corn price ratio and with the inventory of nonruminant animals, the heavy consumers of concentrate feeds. It must be pointed out, however, that demand is still stronger for yellow corn than for cassava because the yellow pigment in the former gives color to poultry eggs and meat. In addition, the highly irregular supply of cassava and the additional costs of processing cassava for feed serve as constraints to further expansion of cassava in feed manufacturing. The domestic price of imported soybean meal, which has been on the average 60 percent higher than the border price, has also affected the use of cassava for feed.

TRADE

Unlike in other countries, cassava industry in the Philippines is not tied to the world market. Exports have been neglible, and imports, consisting mostly of starch, were only 0.08 percent of the total supply from 1961-83 (Table 9). From 1964 to the mid-1970s, cassava starch imports--no matter how small in absolute terms-- registered a rapid rate of growth. At that time, the growing demand for starch by the food and other manufacturing sectors was met through increases in imports. In 1976, however, starch plants in Visayas and Mindanao began operations, resulting in the expansion of cassava production. Imports of starch virtually dropped to zero. The high tariff wall (70 percent) on cassava products provided protection sufficient to allow domestic starch producers to expand output. The high price of corn starch relative to cassava starch in the domestic market likewise encouraged the increase in the use of cassava starch by the manufacturing sector.[2]

TRENDS IN PRICES

The price of cassava tubers increased at an average rate of 12 percent per year from 1969-84 (Figure 3). Abrupt price increases in cassava were observed when rice supplies were short because cassava is a food substitute for cereals (particularly rice) in the rural areas. Such increases occurred in the typhoon crop year of 1972/73, when the price of cassava increased by 26 percent over the previous year, and during the drought of 1983 when, as a result of a bad rice harvest, cassava prices increased in the following year.

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[2]M. G. Binongo, "An Economic Analysis of the Demand for Fresh Cassava and Cassava Products in the Philippines" (M.S. thesis, University of the Philippines, Los Baños, 1985).

Table 9--Imports and exports of cassava products, Philippines, 1961-83

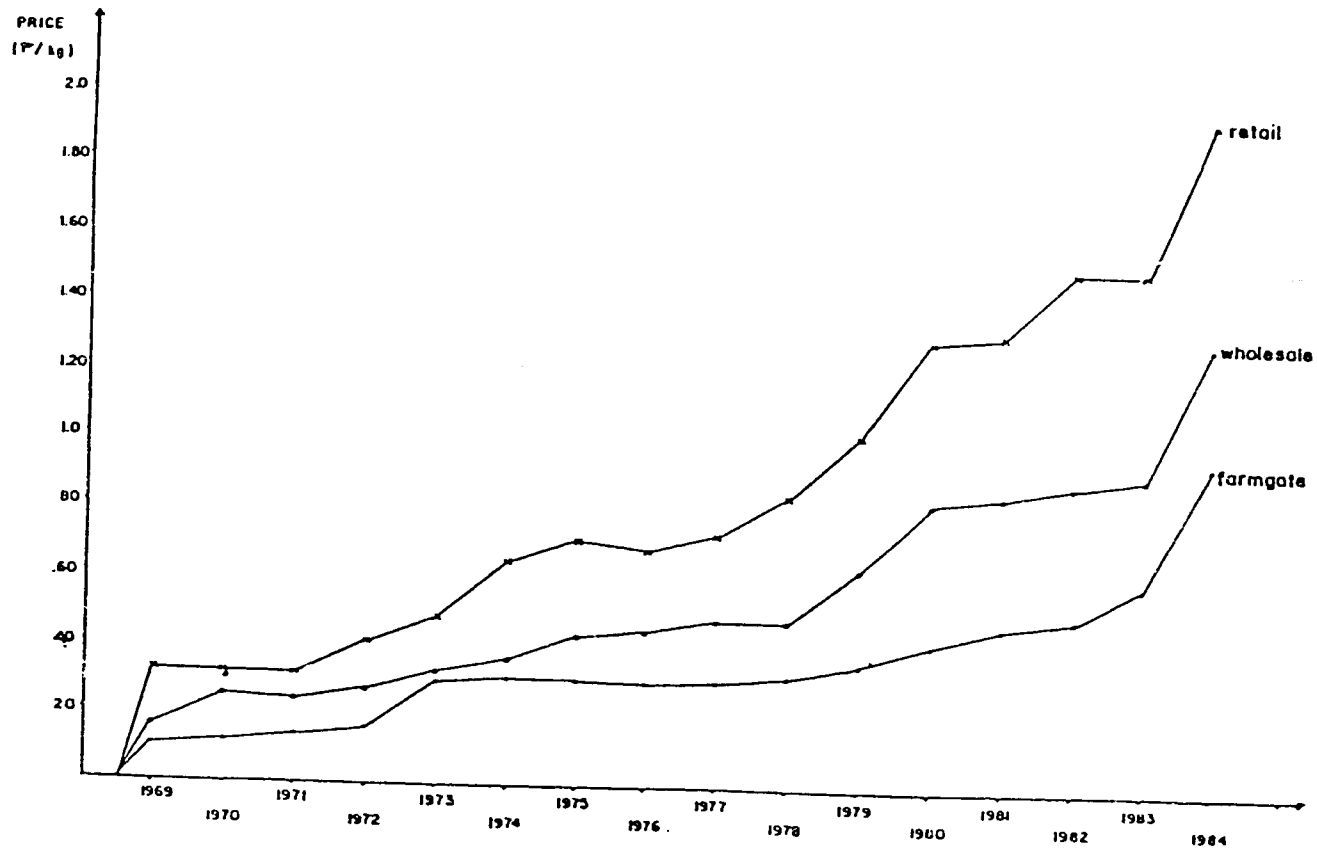
Year	Imports				Exports			
	Tapioca	Starch	Flour and Meal	Total	Fresh and Dried[a]	Sago/ Tapioca[a]	Flour and Meal	Total
	(metric tons of fresh root equivalent)							
1961	...	...	...	...	...	...	...	...
1962	...	...	...	...	...	...	...	...
1963	..	...	...	...	...	...	...	...
1964	222	12	1	235	...	...	...	...
1965	...	.16	...	16	1,035	...	...	1,035
1966	53	738	...	791	...	452	...	452
1967	...	20,191	...	20,191	...	...[a]	...	...[a]
1968	...	6,667	...	6,667	...	...[a]	...	...[a]
1969	...	1,697	...	1,697	...	2	...	2
1970	...	54	...	54	...	107	...	107
1971	...	2,246	...	2,246	...	2	...	2
1972	...	20,678	...	20,678	...	3	...	3
1973	...	12,282	...	12,282	...	1	...	1
1974	...	23,497	...	23,497	...	...[a]	...	...[a]
1975	..4	23,336	...	23,340	...	2	...	2
1976	11,131	...	...	11,131	2	5	2	8
1977	26	...	...	26	1,689	15	5	1,709
1978	16	...	...	16	341	19	8	368
1979	26	...	...	26	829	7	11	847
1980	24	...	...	24	553	22	4	579
1981	18	2,518	6	2,542	305	22	6	333
1982	5	1,944	...	1,949	1,119	31	5	1,155
1983	16	...	3	19	8,109	1,106	65	9,281

Source: Philippines, National Census and Statistics Office, Foreign Trade Statistics (Manila: NCSO, various issues).

Notes: The conversion rate used to put the data in terms of fresh root equivalents was 18 percent.

[a]These figures are in fresh root equivalents.

Figure 3--Retail, wholesale, and farmgate prices of cassava tubers, 1969-84



Source: Philippine Council for Agriculture and Resources Research and Development, Data Series on Rootcrops Statistics in the Philippines (Los Baños: PCARRD, 1985).

Figure 4 shows that the price of fresh cassava followed the same trend as the price of rice through 1987. Furthermore, the monthly price variation of fresh cassava was relatively large (Figures 5-8)--an indication that the supply of cassava was irregular. On processed cassava, data show that from 1976 to 1981, the price of cassava starch declined relative to the price of corn starch. As a result, the share of cassava starch in the total supply and consumption of starch increased (Table 10).

Table 10--Price patterns of cassava and corn starch, 1976-81

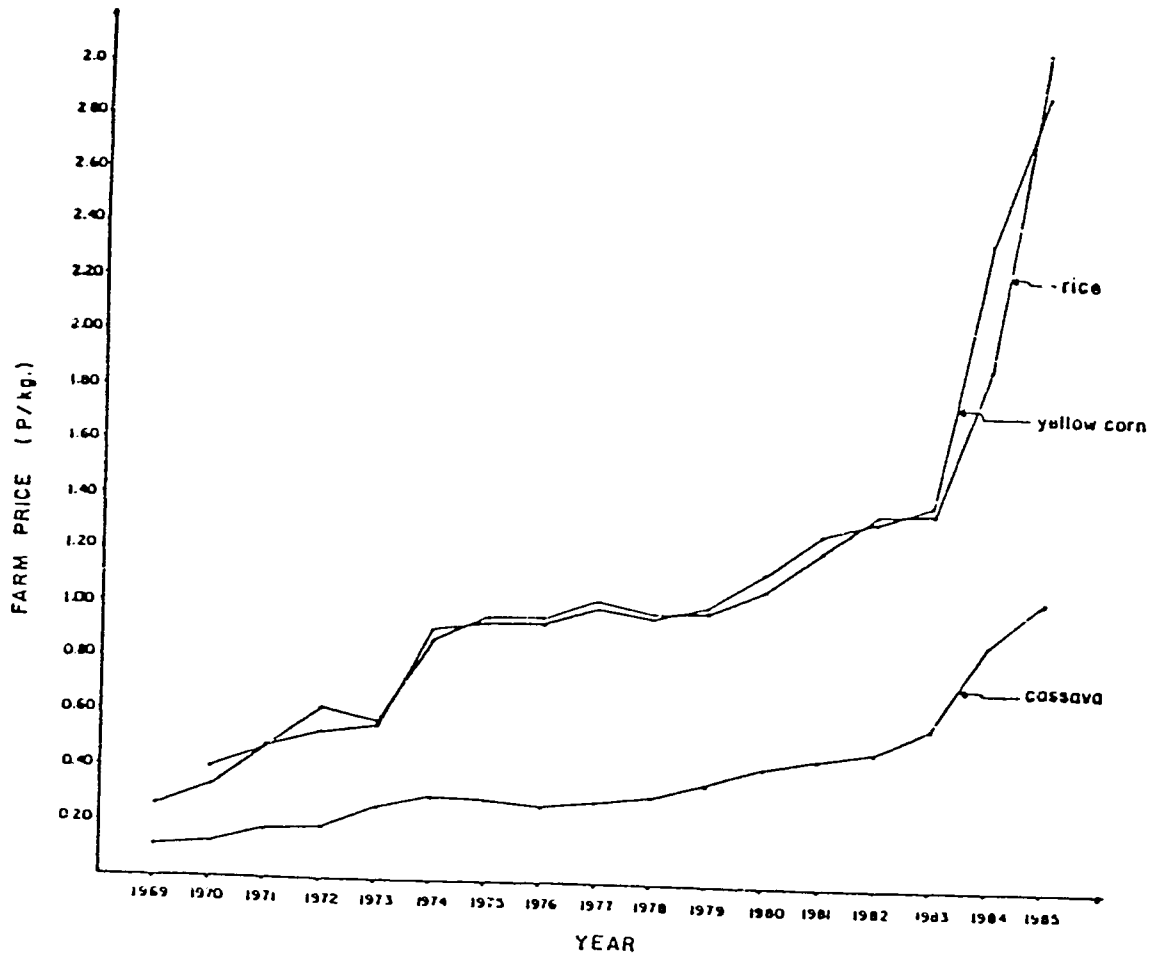
Year	Price of Cassava	Price of Corn Starch	Ratio of Cassava Price to Corn Starch Price	Share of Cassava in Total Starch Supply	Share of Cassava Starch Consumption in Total Starch Consumption
	(₱/50 kilograms)			(percent)	
1976	121.50	106.05	1.14	0.18	0.16
1977	113.26	112.11	1.01	0.18	0.19
1978	104.16	115.80	0.90	0.18	0.19
1979	108.16	117.37	0.92	0.18	0.18
1980	123.69	137.18	0.90	0.19	0.21
1981	142.67	162.55	0.88	0.22	0.25

Source: Development Bank of the Philippines, Business Research Division, unpublished data.

The price of cassava relative to corn is an important determinant in the substitutability of these feed ingredients. In the absence of least-cost feed formulations, a rule of thumb that is commonly used is that when the price of 4 kilograms of cassava combined with 1 kilogram of soybean meal is less than the price of 4 kilograms of corn, then cassava is competitive with corn.[3]

[3]M. Chesley, "The Demand for Livestock Feed in Thailand," Cornell International Agricultural Economics Study, Ithaca, New York, 1985.

Figure 4--Trends in farm prices of cassava, rice, and yellow corn, 1969-85



Source: Philippines, National Feed Authority, unpublished data.

Figure 5--Average monthly seasonal index of fresh cassava farm prices, 1980-85

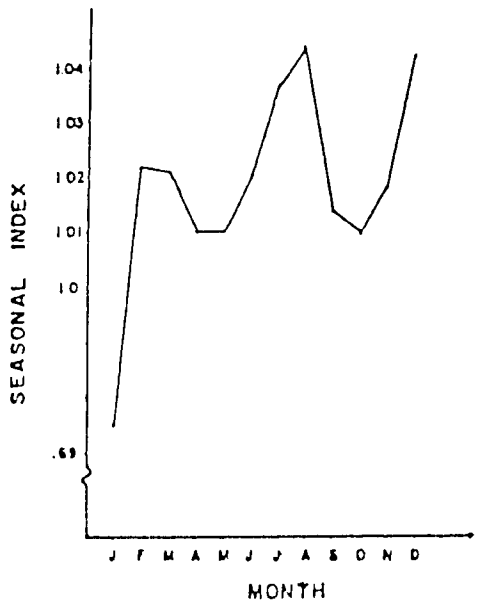


Figure 6--Average monthly seasonal index of cassava (tubers) wholesale prices, 1980-85

Figure 7--Average monthly seasonal index of cassava retail prices, 1980-85

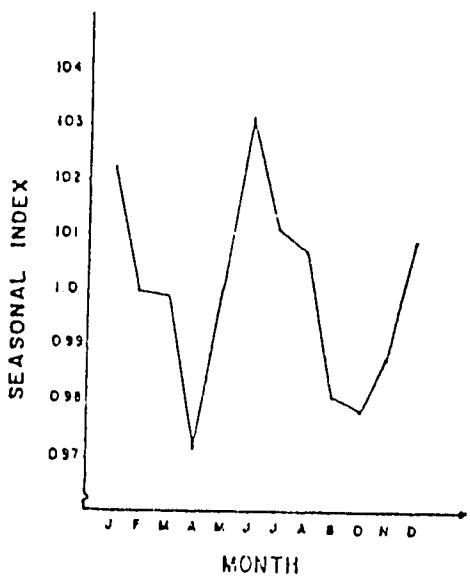


Figure 8--Average monthly seasonal index of cassava (yellow) wholesale prices, 1980-85

Source: M.G. Binongo, "An Economic Analysis of the Demand for Fresh Cassava and Cassava Products in the Philippines" (M.S. thesis, University of the Philippines, Los Baños, Laguna, Philippines, 1985).

Figure 9 shows the trends in the ratio of the domestic wholesale price of the 4:1 ratio cassava/soybean mix to the wholesale price of yellow corn. It appears that given the implicit tariff on soybean meal, the trend in the ratio of wholesale prices (line A) was not favorable for the use of cassava in livestock feeds. For all years except 1981 and 1985, the price of the cassava/soybean mix was higher than the price of yellow corn.

It will be noted, however, that when the border price of soybean meal is assumed (line B), the competitiveness of cassava over corn improves tremendously. Between 1978 and 1985, price ratios were less than one in all years except 1979 and 1982. This implies that liberalizing trade in soybean meal improves the competitiveness of cassava in feed formulations. Surprisingly, the same result is obtained when it is assumed that corn is subjected to nontariff trade restrictions such as the recent corn import ban (line C). Price comparisons made while the ban was in effect showed that the implicit tariff on corn ranged from 30-50 percent. Using an average implicit tariff of 40 percent to derive the domestic wholesale price under the corn import ban, it is apparent that the effect of the ban on the competitiveness of cassava in feed use is the same as the liberalization of soybean imports. This strongly suggests that the prospects of cassava for feed use depend greatly on the pricing policies of the government.

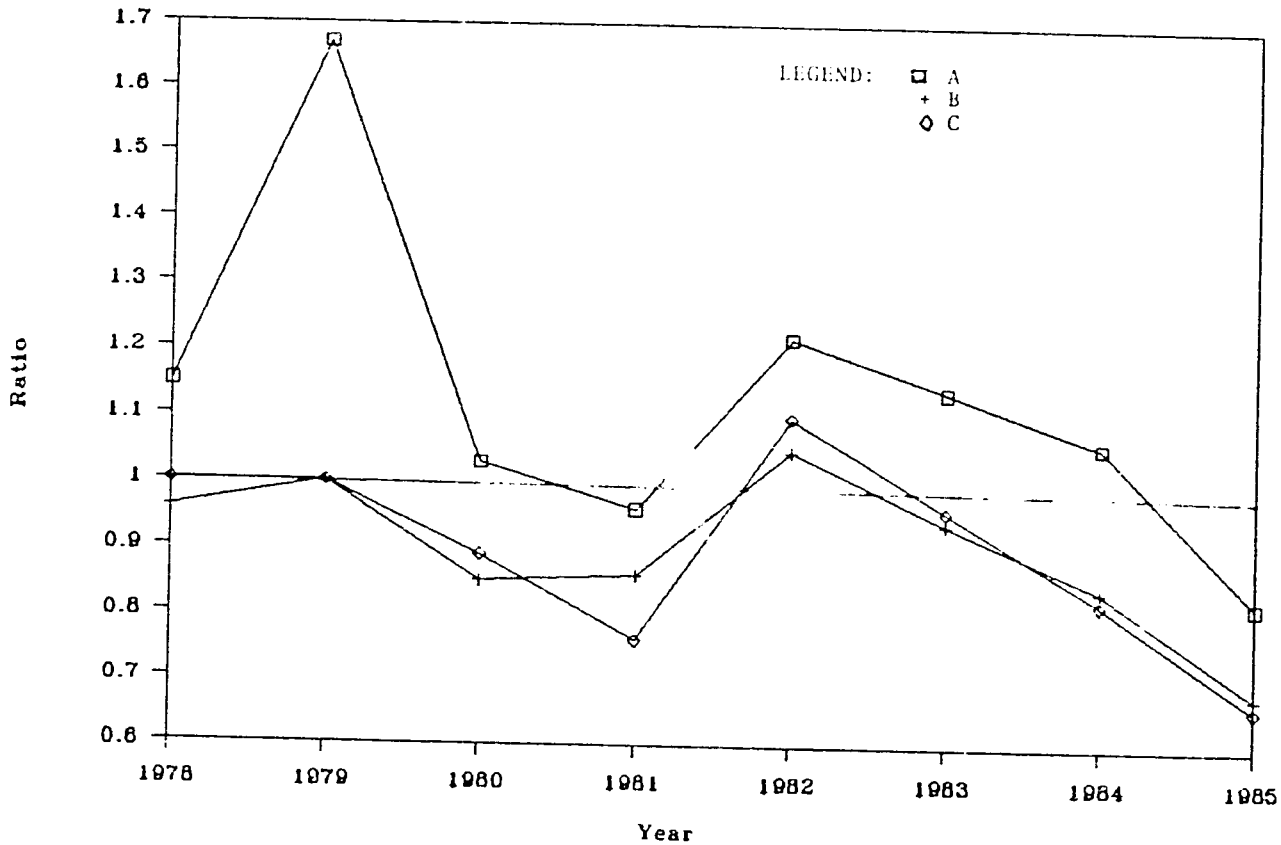
For political reasons, it is likely that in the face of recent international developments (for example, discrimination against the country's coconut oil exports) the high tariff on soybean meal will remain. On the other hand, because protection for the domestic corn producers is increasing, the implicit tariff on corn is expected to increase. Nonetheless, it will be important to note that the net effect of this is a favorable price trend for the use of cassava in feed mixes.

TRENDS IN MANUFACTURED AND PROCESSED CASSAVA PRODUCTION

Processed cassava products come in the form of starch, flour, and glucose. Cassava is also semiprocessed into dried chips used as raw materials for further processing into starch or mixed feed.

Production of dried cassava chips did not become popular until the 1980s when annual production averaged a low 658 tons. The reason for this is that drying was an added cost in cassava processing. It is worth noting, however, that cassava starch production increased at an average annual rate of 4 percent. The rate of increase in the production of cassava starch was particularly favorable during the mid-1970s into the 1980s because of government incentives. Under Presidential Decree No. 1789, issued in 1981, cassava starch manufacturing was considered a preferred, nonpioneer enterprise, and as such, incentives were granted to entities engaged in cassava starch manufacturing (see Appendix 2 for a list of these incentives).

Figure 9--Ratio of the price of a mixture of cassava chips and soybean meal to yellow corn, 1978-85



Sources: For the prices of cassava chips and soybean meal, Philippines, National Food Authority, unpublished data. For the prices of yellow corn, Philippines, Bureau of Agricultural Economics, unpublished data.

Note: The ratios in this figure are of the price of a mixture of 4 kilograms of cassava chips and 1 kilogram of soybean meal to the price of 4 kilograms of yellow corn. For line A, all prices are wholesale. For line B, the price of soybean meal is the border price but the other prices are wholesale. For line C, all prices are wholesale, but corn is subject to an implicit tariff of 30-50 percent.

The 11 starch manufacturers in the Philippines at present have a total rated capacity of 520 tons per day, and there are indications that more firms are going into starch manufacturing.[4] As explained earlier, to ensure a regular supply of cassava tubers, these enterprises enter into contracts with small farmers' who agree to sell cassava tubers to the firm at a preset price.

TRENDS IN PER CAPITA CONSUMPTION

Despite the high calorie content of cassava, surveys in the Philippines show that per capita consumption of cassava is low compared to the traditional sources of calories (Table 11). Filipinos' consumption of cassava is only two-fifths as much as corn and one-twentieth as much as rice.

Urban dwellers consume only one-fifth as much cassava as rural consumers do because their per capita incomes are higher. In Luzon, where per capita income is three times as high as on Visayas and seven times as high as on Mindanao, per capita cassava consumption is 2 kilograms per year, compared to 8 kilograms in Visayas and 15 kilograms in Mindanao. This means that Mindanao residents consume about seven times more and the Visayas consumers around four times more cassava than people in Luzon.

Aggregate figures, however, show a different picture. The annual per capita consumption was 13.12 kilograms in 1961-63, 7.15 kilograms in 1971-73, and 8.18 kilograms in 1981-83 (Table 12). Also, human consumption of cassava as food declined in both aggregate and per capita terms from 1961 to 1971.

During the whole period under review, it is apparent that the per capita consumption declined at an average rate of 2.33 percent per year from 1961-63 to 1981-83. This is due primarily to two reasons. First, the Philippines became a net rice exporter in the 1980s. Second, per capita income grew modestly during the same period (Figure 10).

TRENDS AND PROJECTIONS IN LIVESTOCK PRODUCTS

Historically, the Philippines livestock industry contributed an average of 15 percent to the gross value added (GVA) in agriculture.

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[4]For example, a Swedish firm is building a plant in the province of Zambales with a rated capacity of 500 tons of fresh roots per day.

Table 11--Mean per capita consumption of starchy staples for urban and rural areas, and by island group, 1978

Crop Product	Philippines	Urban	Rural	Luzon	Visayas	Mindanac
	(kilograms/year)					
Cereals and cereal products	134.0	117.9	142.4	131.0	139.1	137.2
Rice	109.5	93.1	117.9	115.3	100.7	106.4
Rice and products	2.9	4.0	2.2	2.3	2.6	2.2
Corn	13.9	6.5	17.9	2.6	31.4	31.0
Corn and corn products	..[a]	..[a]	..[a]	..[a]	..[a]	0.4
Other cereals	7.7	14.2	4.4	10.2	41.4	3.3
Starchy roots and tubers	13.5	7.3	16.8	10.2	14.2	26.6
Cassava and products	5.5	1.5	7.3	2.2	8.0	15.0
Sweet potatoes	5.1	3.3	6.2	5.5	3.3	6.9
Potatoes and products	0.7	1.1	0.4	0.7	0.7	1.1
Others	2.2	1.5	2.9	1.8	2.9	4.0

Source: Food and Nutrition Research Institute, First Nationwide Nutrition Survey, Summary Report (Los Baños: FNRI, 1978).

Notes : The data are for products purchased at retail prices. They are as they were available in the kitchen, including inedible and edible waste.

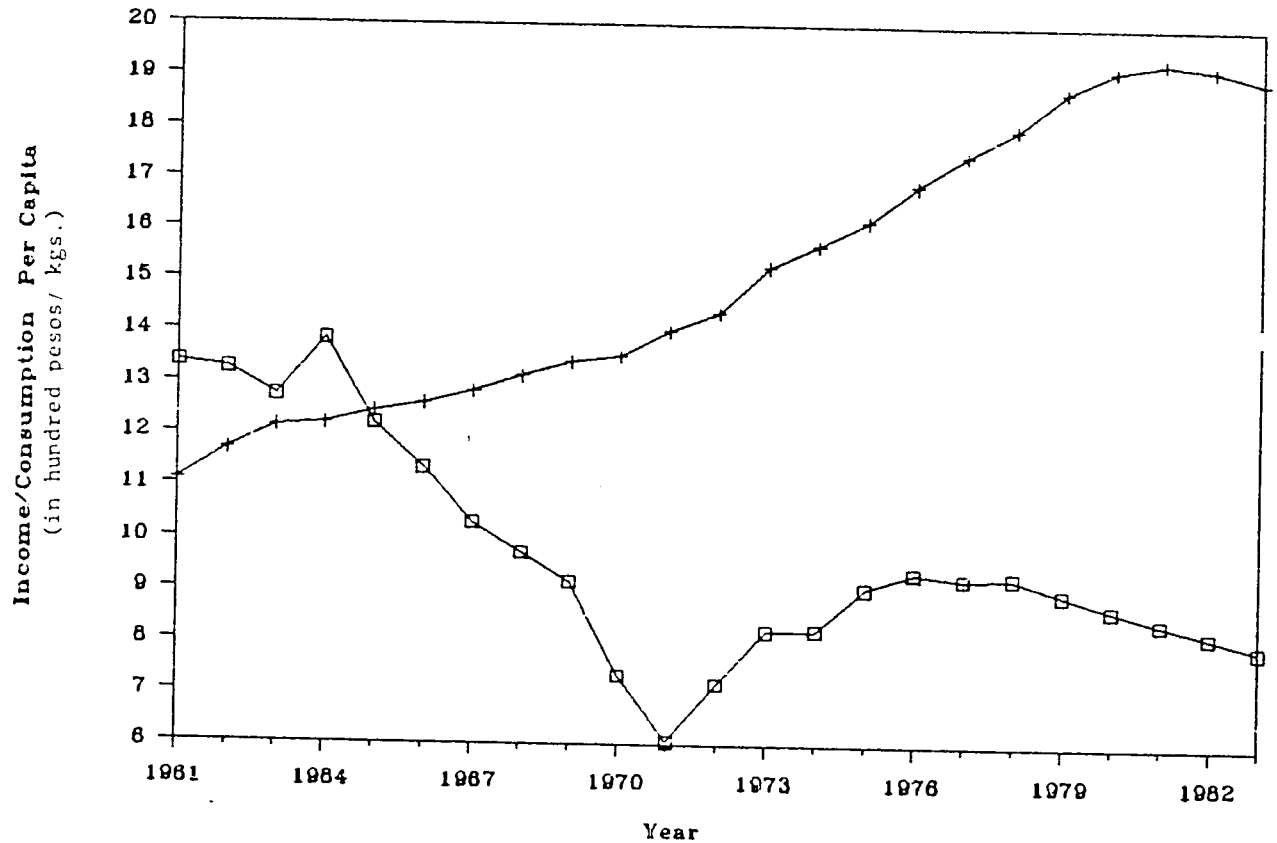
[a]This figure was less than 0.5 grams.

Table 12--Trends in per capita consumption of cassava, per capita income, and population, 1961-83

Year	Cassava Use for Food Total	Cassava Use for Food Per Capita	Per Capita Income	Population
	(metric tons)	(kilograms)	(₱)	(million)
1961	377,034	13.37	1,109	28.2
1962	385,575	13.25	1,171	29.1
1963	381,030	12.74	1,215	29.9
1964	425,976	13.83	1,220	30.8
1965	388,278	12.21	1,244	31.8
1966	371,145	11.35	1,260	32.7
1967	347,447	10.31	1,283	33.7
1968	337,631	9.73	1,314	34.7
1969	328,286	9.17	1,341	35.8
1970	269,744	7.33	1,353	36.8
1971	229,295	6.05	1,402	37.9
1972	278,913	7.17	1,437	38.9
1973	328,913	8.22	1,528	40.0
1974	338,363	8.23	1,569	41.1
1975	383,661	9.07	1,618	42.3
1976	406,658	9.37	1,690	43.4
1977	417,996	9.26	1,749	44.6
1978	425,482	9.29	1,801	45.8
1979	422,060	8.98	1,874	47.0
1980	419,727	8.69	1,917	48.3
1981	417,285	8.43	1,933	49.5
1982	416,362	8.18	1,921	50.9
1983	413,153	7.93	1,897	52.1

Sources: The data for food use are from National Economic and Development Authority, Food Balance Sheets (Manila: NEDA, various issues, 1961-81) and IAPMP (Integrated Agricultural Production and Marketing Project), Philippine Food and Agricultural Development for the 1980s (Manila: IAPMP, 1981). They include adjustments for some years. The data for per capita income and population are from the Economic Planning and Research Staff of the National Economic and Development Authority.

Figure 10--Trends in per capita income and per capita consumption of cassava, 1961-83



Sources: For per capita income, National Economic and Development Authority, Statistical Yearbook 1983 (Manila: NEDA, 1983); for per capita consumption, National Economics and Development Authority, Food Balance Sheets, various issues.

Most of this consisted of beef, pork, poultry meat, and eggs.[5] The proportion of meat coming from water buffalo is at present quite small because they are raised primarily as work animals rather than as a source of meat.[6]

A livestock inventory shows that animals, particularly ruminants such as cattle and water buffalo, are raised predominantly in backyard farms (Table 13). But growth of the commercial sector, especially for the nonruminants (such as hogs and poultry), has been evident since the early 1970s due to the emergence of the contract growing scheme in poultry and hogs.

The trend in meat, eggs, and dairy production showed a favorable growth in livestock production through 1981 (Table 14). Significant growth in pork production from the 1960s to the 1970s can be observed. Chicken meat production grew at a consistently high level, 9.3 percent per year from 1961-63 to 1979-81. There was a jump in the growth rate of egg production, but milk production declined during most of the 1970s.

This favorable trend in meat production was due to the growth both in the number of animals slaughtered and the increase in the weight of the animals. There was also an increase in feed efficiency. Arboleda notes that while it used to take more than 14 weeks to grow a kilogram live weight of broiler, it is now common to attain it in only six weeks.[7] As a result, it now takes only 2 kilograms of feed to produce a kilogram of chicken meat compared to 8 kilos of feed to attain the same weight several years ago. Similarly it now takes only 2 kilograms of feed to produce a dozen eggs compared to 8 kilos of feed several years ago. Similar observations can be made about hogs.

Hogs traditionally contributed around 60 percent of the total meat supply, and poultry supplied around 15 percent. Ruminants have been a relatively minor source of meat and will likely be so in the future.

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[5]Dairy animals compose an insignificant proportion of the total. The value of their production makes up a small proportion of agriculture's gross value added. Therefore dairy products are not included in the analysis that follows.

[6]Liborio S. Cabanilla, "Economic Incentives and Comparative Advantage in Livestock Production" (Ph.D. thesis, University of the Philippines, Los Baños, 1983).

[7]C. R. Arboleda, "Genetic Improvement of the Chicken and the Development of the Philippine Poultry Industry," paper presented at a lecture series, A Tribute to Dr. Fronda, University of the Philippines, Los Baños, 1980.

Table 13--Distribution of animal population between the commercial sector and backyard farms, 1976-85

Year	Water Buffalo		Cattle		Swine		Poultry	
	Commercial Sector	Backyard Farms	Commercial Sector	Backyard Farms	Commercial Sector	Backyard Farms	Commercial Sector	Backyard Farms
				(percent)				
1976	...	...	23	77	8	92	18	82
1977	1	99	24	76	14	86	28	72
1978	2	98	27	73	18	82	30	70
1979	1	99	24	76	18	82	25	75
1980	2	98	22	78	18	82	25	75
1981	2	98	24	76	21	79	32	68
1982	1	99	24	76	21	79	33	67
1983	1	99	22	78	19	81	32	68
1984	1	99	18	82	16	84	31	69
1985	1	99	16	84	18	82	24	76

Source: Philippines, Bureau of Agricultural Economics, unpublished data.

Most meat imports are beef. Except for the substantial imports of poultry meat and eggs during the early postwar years and some token amounts in the mid-1960s, imports have generally made up less than 10 percent of the total supply of beef and less than 1 percent of the supply of pork, chicken, and eggs. Imports of milk, on the other hand, have been substantial (see Table 15). Estimates by the International Food Policy Research Institute (IFPRI) show that the country will be deficient in livestock products in the future.[8] And because of the government's drive to conserve foreign exchange and efforts to prevent imports of livestock products (except for milk where no comparative advantage exists), a shortage is likely in the future. This implies that the expected increase in demand due to the growth of population and per capita income will create pressure for domestic livestock production, and, therefore, feed production to expand.

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[8]J. S. Sarma, Livestock Products in the Third World: Past Trends and Projections to 1990 and 2000, Research Report 49 (Washington, D.C.:International Food Policy Research Institute, 1985).

Table 14--Trends in production of meat, eggs, and milk, 1961-81

Year	Beef and Buffalo Meat	Pork	Poultry Meat	Eggs	Dairy Milk
		(metric tons)			
1961	51,211	305,695	44,625	111,787	8,812
1962	53,004	306,584	43,341	85,527	8,829
1963	42,168	258,947	45,181	79,648	8,030
1964	41,515	266,548	46,624	91,439	8,128
1965	40,944	274,372	48,092	92,611	8,229
1966	73,660	359,698	87,928	85,894	8,998
1967	70,583	360,984	86,837	92,099	9,000
1968	89,735	300,537	120,281	115,159	9,400
1969	94,056	305,079	108,349	132,299	24,149
1970	105,681	305,608	93,167	112,319	25,254
1971	108,609	300,967	101,895	125,200	26,094
1972	118,290	318,240	109,229	146,553	27,132
1973	128,711	357,811	117,092	160,864	28,768
1974	135,139	372,123	121,848	171,128	32,874
1975	170,898	590,019	125,705	155,076	13,179
1976	160,611	502,625	125,705	153,194	13,267
1977	213,660	502,297	129,562	226,869	10,208
1978	225,210	510,265	127,582	227,630	10,151
1979	233,778	637,495	198,750	190,870	10,300
1980	252,161	561,246	220,144	199,173	10,283
1981	234,371	602,682	242,826	213,813	11,326

Source: National Economic and Development Authority, Food Balance Sheets (Manila: NEDA, various issues, 1961-82).

Table 15--Import volume and value of fresh meat and meat preparations, 1965-84

Product	1965-69		1970-74		1975-79		1980-84	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(metric tons)	(US$1,000)	(metric tons)	(US$1,000)	(metric tons)	(US$1,000)	(metric tons)	(US$1,00)
Fresh meat	...	2,549	2,863	2,909	12,172	13,740	6,394	14,068
Beef	2,010	1,979	1,420	2,146	10,331	12,088	4,545	11,853
Pork	549	260	883	472	879	680	838	854
Edible offals	597	204	415	205	773	657	869	1,024
Others	n.a.	106	145	86	189	315	142	537
Meat preparations	7,367	5,780	1,990	1,817	205	466	122	192
Uncanned	62	34	1	2	7	47	5	47
Canned	7,305	5,746	1,989	1,815	278	419	117	145
Total	...	8,329	4,953	4,726	12,457	14,206	6,516	14,260

Source: Food and Agriculture Organization of the United Nations, FAO Trade Yearbook, various issues (Rome:FAO, various years).

Note: The value figures are c.i.f. Where n.a. appears, the figure was not available.

Based on past trends, as shown in Table 13 and Figure 11, it can be projected that total domestic production of meat and eggs will be those shown in Table 16. Poultry meat production will increase to 513,820 tons by 1990 and 1,150,956 tons by 2000. Pork production will increase to 938,978 tons in 1990 and 1,521,144 tons by 2000. Beef production will substantially increase but dairy production, for lack of comparative advantage, is not expected to grow much.

TRENDS IN CEREAL AND OTHER FEEDS

The derived demand for feeds has increased in the past because of the increase in demand for livestock products. It is important to note however, that the Philippines has not been able to produce all the feed needed by the growing livestock sector. As can be seen in Figure 12, feed imports grew in geometric proportions between 1965 and 1984, especially in the late 1970s.

Feed imports consisted mainly of four ingredients--yellow corn, soybean meal, fish meal, and meat and bone meal. About 35 percent of the total feed mix in both hog and poultry feeds was corn. This represented the largest share of imports and averaged 331,000 tons annually from 1980 to 1984. Soybean meal imports were the largest by value, however, averaging U.S. $75 million annually during the same period (Table 17).

It is likely that the trends in imports of protein feeds (fish meal, soybean meal, and meat meal) will continue in the future.The opportunity cost of fish and meat as human food remains high, hence it precludes expansion of domestic production of fish and meat meal.[9] The small quantity of fish meal domestically produced comes from rotten fish considered unfit for human consumption. On the other hand, domestic production of soybean meal, a by-product of soybean oil manufacturing, is constrained by the thin demand for soybean oil. It is also apparent that farm technology on soybean production is at present far from being well developed.

The prospects for corn depend on the success of the present corn production program. It is worth noting that the government, after having successfully attained self-sufficiency in rice, has now shifted the corn production program into high gear. Toward the end of 1986, the government also announced a ban on corn imports. Several agri-business companies are now producing hybrid seeds in response to the expected increase in demand for seed materials. Corn production, in fact, grew at an average rate of 4.6 percent annually between 1961 and 1984, with a conspicuous increase in growth during the 1980s (Figure 13).

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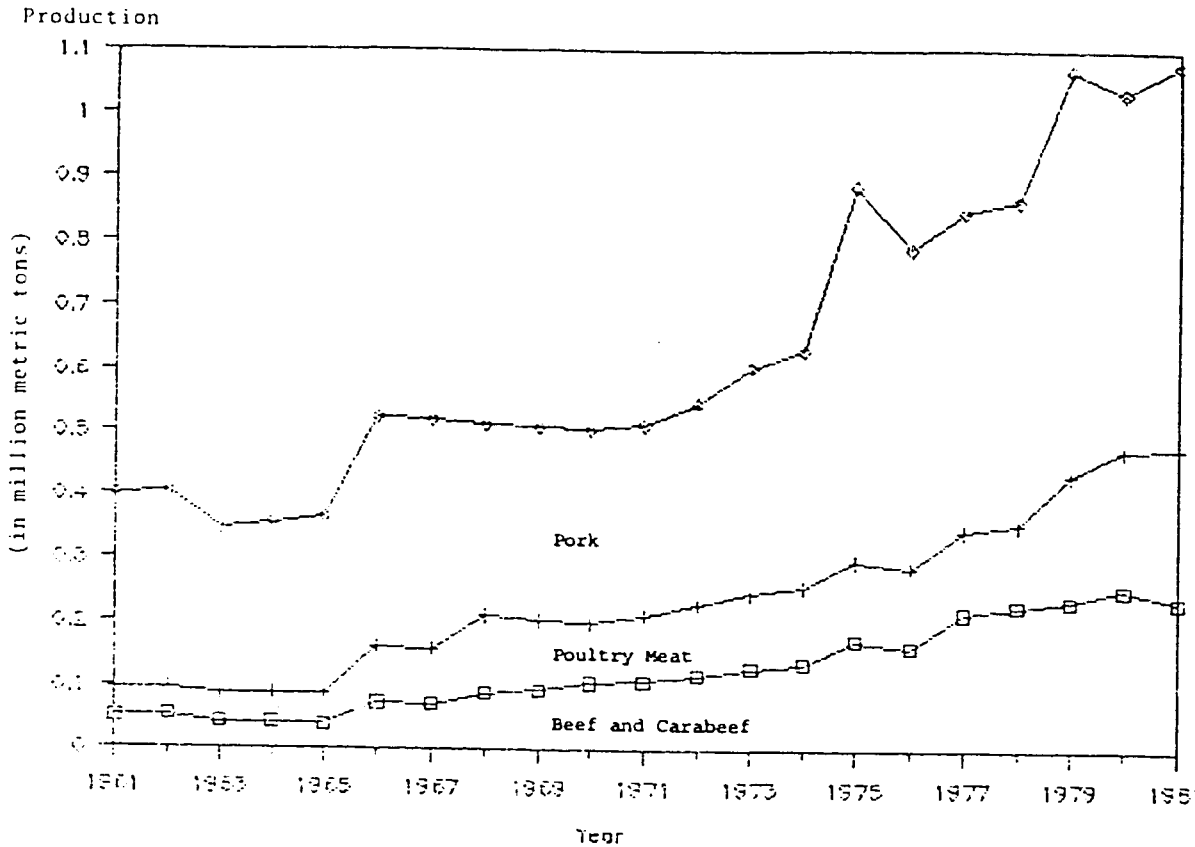
[9]Cabanilla, "Economic Incentives and Comparative Advantage."

Figure 11--Trends in meat production, 1961-83



Source: National Economic and Development Authority, Food Balance Sheets, various issues.

Table 16--Actual production of meat, eggs, and milk, 1961-81, and projections to 1990 and 2000

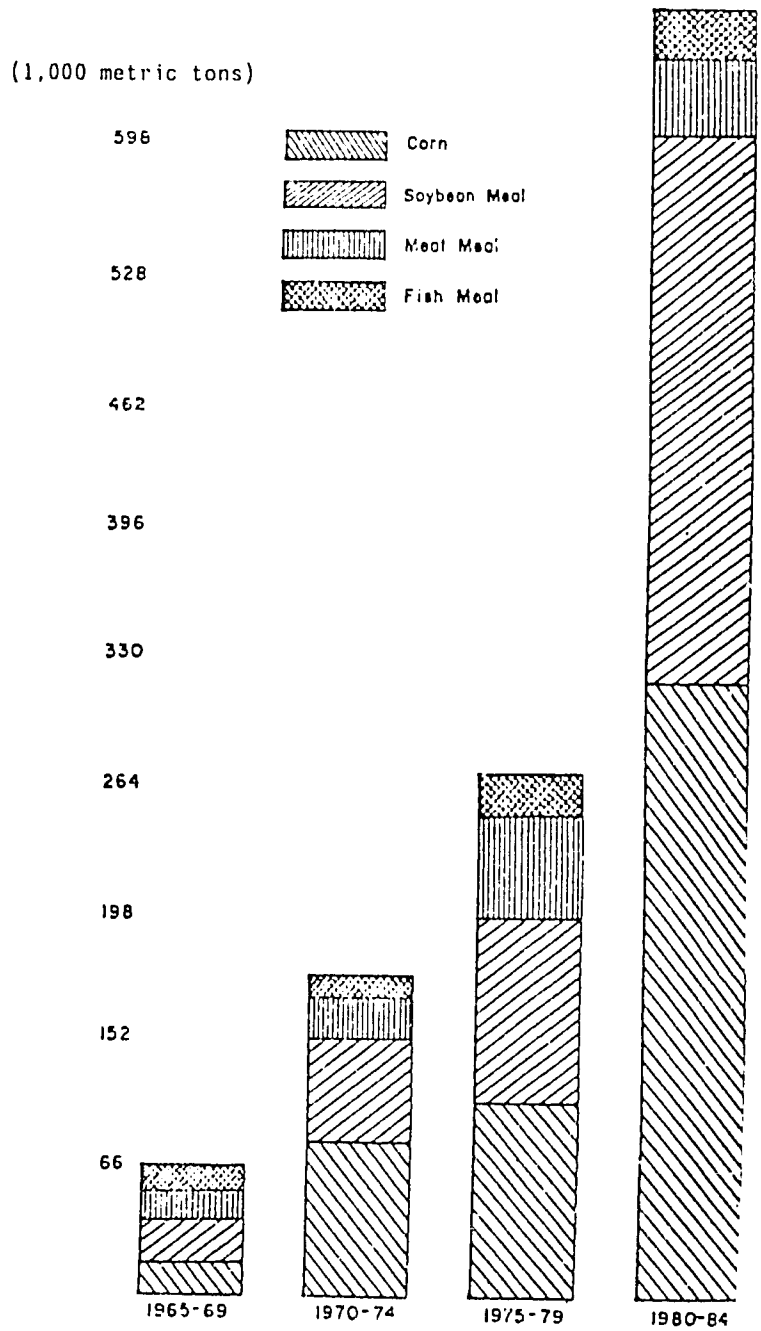
Year	Beef and Buffalo Meat	Pork	Poultry Meat	Eggs	Dairy Milk
			(metric tons)		
Actual					
1961-65	45,768	282,429	45,573	92,202	8,406
1966-70	86,743	326,381	99,312	107,554	15,360
1971-75	132,329	387,832	115,154	151,764	25,609
1976-80	217,084	542,786	160,349	199,547	10,842
1981	234,371	602,682	242,826	213,813	11,326
Projected					
1990	455,852	938,978	513,820	298,483	17,748
2000	934,497	1,521,144	1,150,956	429,815	28,929

Source: National Economic and Development Authority, Food Balance Sheets (Manila: NEDA, various issues, 1961-82).

Note: The projections were computed by extending the average annual growth rates for 1961-81 from production in 1981.

Because of the apparent inability of the Philippines to produce traditional feedstuffs such as corn, there is a need to develop substitutes further. Cassava seems to offer the best potential.

Figure 12--Average quantity of imports of major feed ingredients



Source: Philippines, National Census and Statistics Office, Foreign Trade Statistics (Manila: NCSO, various issues).

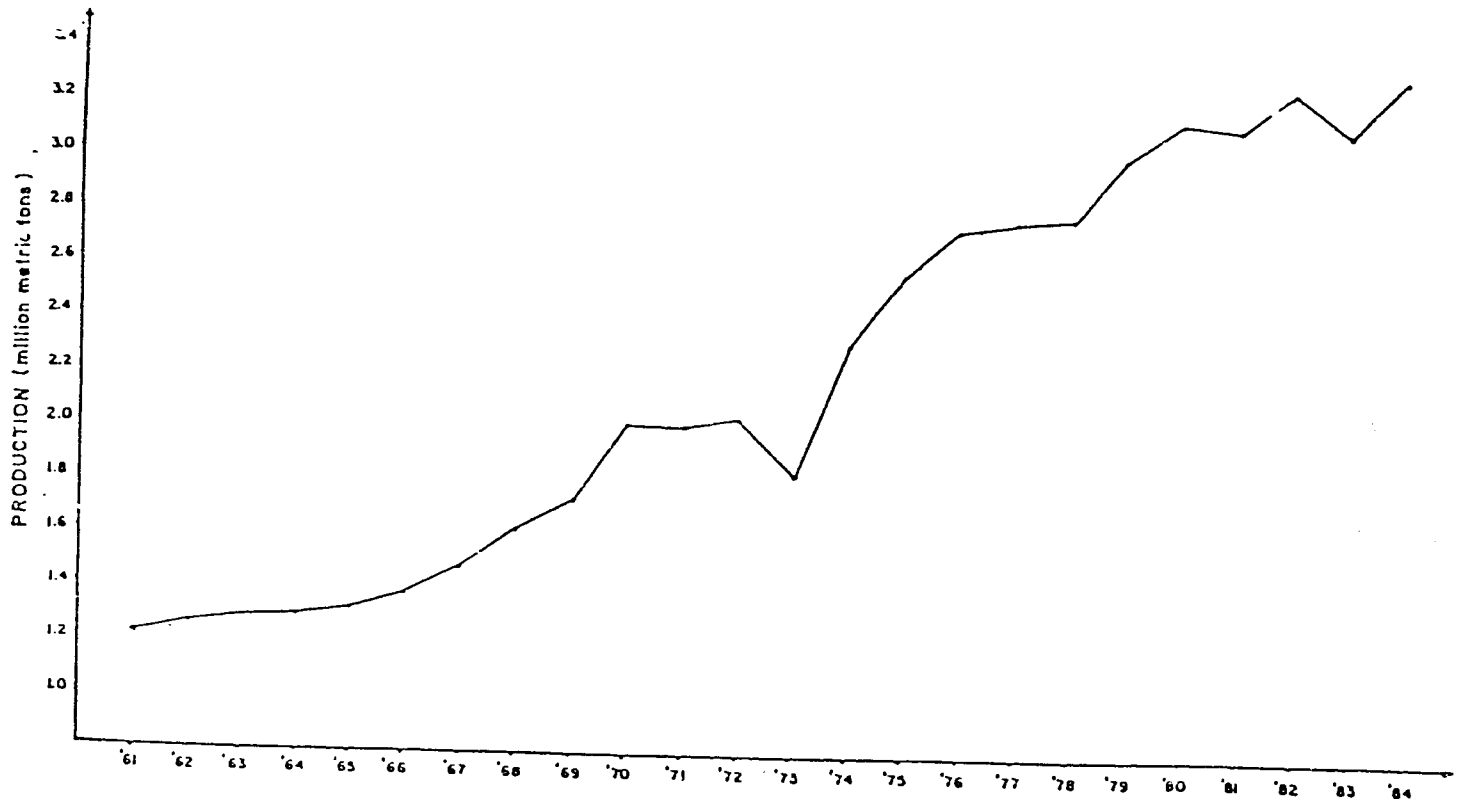
Table 17--Volume and value of imports and exports of feedstuffs, 1965-84

Product	1965-69		1970-74		1975-79		1980-84	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(metric tons)	(US$1,000)	(metric tons)	(US$1,000)	(metric tons)	(US$1,000)	(metric tons)	(US$1,000)
Imports	...	7,479	166,480	24,303	270,611	58,725	678,729	155,626
Fish Meal	12,754	2,238	8,404	1,832	20,209	7,215	24,067	8,492
Meat meal	13,623	1,550	21,513	4,710	50,582	13,387	40,147	12,995
Soybean meal	23,429	2,528	51,588	8,770	90,256	22,695	287,793	75,250
Yellow corn	15,619	1,053	81,315	8,184	101,268	13,426	310,933	51,320
Others	...	110	3,660	807	8,296	2,602	15,789	7,569
Exports	...	23,459	955,053	39,788	1,048,031	85,776	1,032,607	108,262
Copra Meal	201,028	12,433	277,466	19,630	463,936	60,116	576,263	76,570
Molasses	376,028	7,839	630,700	17,752	573,261	24,336	445,425	28,047
Bran	56,906	2,902	39,253	1,984	...	...	...	...
Ipil-Ipil	...	...	...	...	5,286	538	9,495	1,405
Others	...	285	7,634	422	5,548	786	1,424	2,244
Net exports	...	15,980	...	15,483	...	27,051	...	-47,364

Source: Philippines, National Census and Statistics Office, Foreign Trade Statistics (Manila: NCSO, various issues, 1965-85).

Notes: Imports are in c.i.f. values. Exports are in f.o.b. values.

Figure 13--Trend in production of shelled corn, 1961-84



Source: Philippines, Bureau of Agricultural Economics, unpublished data.

3. EXISTING AND POTENTIAL YIELDS AND PROFITABILITY OF CASSAVA

Given the current productivity and farmers' practices, there appears to be a strong potential for increasing yields. Technical experts on cassava attest that when farmers follow the recommended practices, productivity will substantially improve.

Since cassava is grown under nonirrigated conditions, the following discussion will be based on nonirrigated conditions. The approach involves a comparison of yields from farmers' fields (without fertilizer application) with those of on-farm trials conducted by the Philippine Rootcrop Research and Training Center. The gap will be taken to represent the potential increases in farmers' yields.

YIELDS AND FERTILIZER

Table 18 shows the yields of cassava in farm trials conducted in four villages in Baybay, Leyte in 1985/86. Note that on ordinary soil,

Table 18--Yields of cassava in farm trials held in four villages, Baybay, Leyte, 1985-86

Fertilizer Application	Ordinary Soil			Alluvial Soil
	Cartagnos	Kabalasan	Maganhan	Igang
(kilograms of NPK)	(kilograms/hectare)			
0-0-0	5,667	4,891	8,996	20,827
60-30-30	23,250	...	...	...
30-15-15	16,083	...	...	...
60-0-0	...	13,966	...	...
120-0-0	...	15,538	...	...
17.5-17.5-17.5	...	18,317	...	...
35-35-35	...	20,050	...	...
25-25-25	...	...	...	21,733
50-50-50	...	...	...	26,765
Yield difference[a]	6,760	7,269	10,187	3,422

Source: Visayas College of Agriculture, Philippine Rootcrop Research and Training Center, unpublished data.

[a] This is the difference between the average yields with fertilizer applications and without them.

there is a substantial difference in yields between farms that apply fertilizer and those that do not. Among the three villages on ordinary soils, the yield differences resulting from the use of fertilizer range between 6.8 tons and 10.0 tons per hectare. Alluvial (riverbank) soils, on the other hand, produce a yield difference of around 3.4 tons per hectare.

These numbers, and discussions with scientists at the Philippine Rootcrops Research and Training Center, indicate that fertilizer use is the crucial factor in explaining cassava yield. Through fertilizer use, farmers working on ordinary soil will realize a net increase in yield of at least 7 tons. In some previous studies, farmers were found to be not too keen on applying fertilizers because they thought that fertilizers were expensive (see Table 19).[10] But the recent government move to liberalize trade in fertilizer has resulted in a decrease in fertilizer prices in contrast to the increasing trend during the late 1980s (Figure 14).

Table 19 -- Farmers' reasons for not applying fertilizer

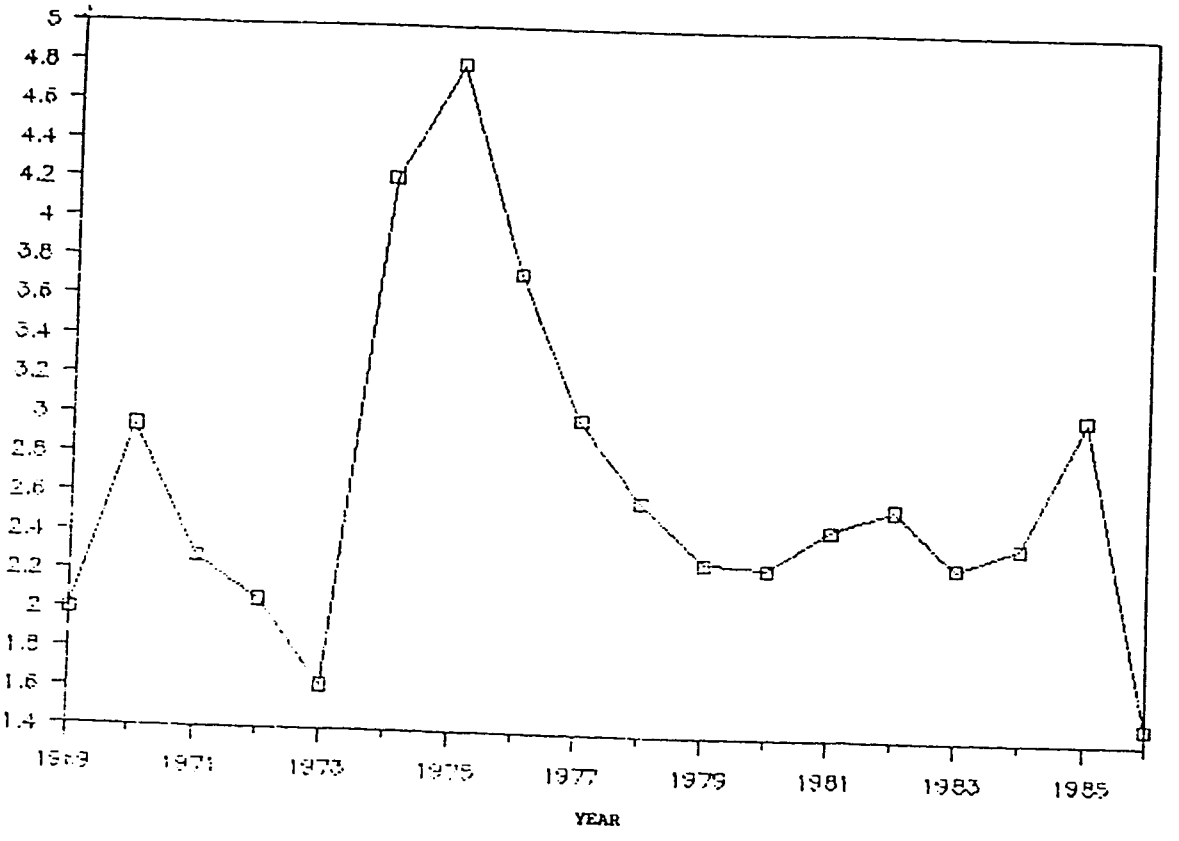
Reason	Type of Farmer		All Farmers
	Processor	Nonprocessor	
		(percent)	
Expensive	82	75	77
Not necessary	27	34	32
No knowledge	1	1	1
Others[a]	4	3	3

Source: J. M. Alkuino, Jr., "Socio-economic Study of Rootcrop Growers and Processors in Leyte with Emphasis on the Targeted Respondents in Hilongos and Maasin," Visayas State College of Agriculture, Department of Agricultural Economics, Visayas, February 1986.

[a] These reasons include the beliefs that the soil was becoming used to the fertilizer and that the soil was already fertile.

[10] J. M. Alkuino, Jr., "Socio-economic Study of Rootcrop Growers and Processors in Leyte with Emphasis on the Targeted Respondents in Hilongos and Massin," Department of Agricultural Economics, Visayas State College of Agriculture, 1986.

Figure 14--Fertilizer-cassava price ratio, 1969-86



Sources: For cassava prices, Philippine Council for Agriculture and resources Research and Development, Data Series on Rootcrops Statistics in the Philippines (Los Baños, Laguna: PCARRD, 1985); for fertilizer prices, Philippines, Bureau of Agricultural Economics, unpublished data.

Based on the new trend in fertilizer prices, it can be predicted that cassava farmers will be more encouraged to apply fertilizer, which will raise the average yield per hectare. And since some farmers are now planting the new varieties, it is not farfetched to achieve a 15 ton per hectare yield by 2000. However, because of the long production cycle, which hampers the introduction and multiplication of improved varieties, an average yield of 12 tons per hectare will be assumed in the discussion.

Estimates were made of the costs and returns of the farm trial in one village (Cantagnos). They showed a substantial reduction in costs per unit of output if farmers fertilize--from P1,026 to P433 per ton (Table 20). Net income also increased by more than P1,500.

Table 20--Costs and returns of cassava farms, with and without fertilizer, 1984

Cost/Return	Without Fertilizer	With Fertilizer
Total cost	5,819.16	6,972.01
Cash cost (₱/hectare)	2,021.40	2,794.27
Current inputs (fertilizers, sacks, seedpieces)	896.65	1,649.25
Others (interest on capital, miscellaneous)	1,115.75	1,145.02
Noncash cost (₱/hectare)	3,806.76	4,177.74
Family labor (land preparation, planting, weeding, fertilization, harvesting)	2,817.50	2,992.50
Total return (₱/hectare)	3,500.00	10,599.75
Yield (metric ton/hectare)	5.67	16.08
Price (₱/metric ton)	617.28	659.19
Net farm income (₱/hectare)	-2,319.16	3,627.74
Net return above cash cost (₱/hectare)	1,487.60	7,805.48
Rate of return to cash cost	1.74	3.79
Rate of return to total cost	0.60	1.52
Production cost (₱/metric ton)	1,026.31	433.58

Source: Visayas College of Agriculture, Philippine Rootcrop Research and Training Center, unpublished data.

SCOPE FOR SUBSTITUTION OF CASSAVA FOR MAIZE AND SORGHUM

Since cassava is a good substitute for other energy foods like corn, it can be expected to compete with those crops for available land as demand for energy foods increases. The critical factor in this competition is profitability. Where a crop can be expected to contribute an insignificant marginal increase to total family income, the farmer will not expand production of that crop beyond family subsistence needs.

Data used in the analysis of the costs and returns of cassava, corn, and sorghum came from published reports and discussions with cassava experts and researchers. Table 21 summarizes these data. Except for hybrid corn, farmers planting these crops received a negative net farm income, although returns above cash costs (the prime consideration in farmers' decisions) are all positive.

A close scrutiny of on-farm trials and other farm-level data show, however, that there is room for improving the profitability of cassava farming. As shown above, all that farmers need to do is to fertilize their crops. On-farm trials conducted by the Visayas State College of Agriculture (VISCA) show that the marginal contribution of fertilizer applications on yields at the farm level is encouraging (see Table 18). Data from a contract growing system in Bohol likewise indicate that fertilizer use doubles yield per hectare, and as a result production cost per ton declines significantly from P1,026.31 to P433.58 (Table 20). A comparison of the farmer's practices reflected in the survey conducted by Gonzales with the farm trials shows the same thing.[11] Costs fall and income increases by around P6,000 (Table 21). The decline in the cost of cassava production improves its substitutability for corn in feeds. The increase in profitability through proper cultural practices (such as fertilizer use) on the other hand, makes it more attractive to farmers relative to other crops.

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[11]Leonardo A. Gonzales, "Price and Investment Policies for Food Crop Sector Growth in the Philippines," International Food Policy Research Institute, Washington, D.C., 1985.

Table 21--Comparative costs and returns of cassava, corn, and sorghum, 1984

Cost/Return	Cassava		Corn					
	Average Yields		White Variety		Yellow Variety			
	5 Metric Tons Per Hectare	16 Metric Tons Per Hectare	Traditional	Improved	Traditional	Improved	Hybrid	Sorghum
Total cost	2,744.43	6,972.01	1,984.43	2,316.33	2,197.94	2,546.70	3,472.35	2,062.37
Cash cost (₱/hectare)	1,638.98	2,794.27	719.33	910.64	838.42	1,224.57	2,334.98	760.75
Noncash cost (₱/hectare)	1,105.45	4,177.74	1,265.14	1,405.69	1,359.52	1,322.13	1,137.37	1,301.62
Total returns (₱/hectare)	2,450.72	10,599.75	1,902.36	1,742.44	1,813.13	2,330.52	4,737.74	1,881.47
Yield (metric ton/hectare)	5.00	16.08	1.48	1.39	1.36	1.80	3.67	1.56
Price (₱/metric ton)	540.00	659.19	1,285.38	1,253.89	1,333.18	1,294.73	1,290.94	1,206.07
Net farm income (₱/hectare)	-273.71	3,627.74	-82.07	-573.89	-384.81	-216.18	1,265.39	-180.90
Net return above cash cost (₱/hectare)	811.74	7,805.48	1,183.03	831.80	974.71	1,105.95	2,402.76	1,120.72
Rate of return to cash cost	1.50	3.79	2.64	1.91	2.16	1.90	2.03	2.47
Rate of return to total cost	0.89	1.52	0.96	0.75	0.82	0.92	1.36	0.91
Production cost (₱/metric ton)	548.89	433.58	1,340.83	1,666.42	1,616.13	1,414.83	946.14	1,322.03

Sources: The data for low-yield cassava, corn, and sorghum are from Leonardo A. Gonzales, "Price and Investment Policies for Food Crop Sector Growth in the Philippines," International Food Policy Research Institute, Washington, D.C. 1985. The data for high-yield cassava are from Visayas College of Agriculture, Philippine Rootcrop Research Training Center, unpublished data.

4. CURRENT SITUATION AND PAST TRENDS OF COMPOUND MIXED FEEDS

Total mixed feed production in the Philippines averaged nearly 995,000 tons per year during the years 1983-85. The bulk of this was produced by commercial feed manufacturers and the rest was produced by independent commercial livestock raisers who mixed their own feeds.

In 1985, a total of 123 commercial feed millers were operating with a total rated capacity of 1.5 million metric tons annually. Most of these mills are located around metropolitan Manila and surrounding regions (Table 22), where 66 percent of the member mills (equivalent to 74 percent of the total rated capacity) is concentrated. There are two important reasons for this phenomenon. First, demand for commercially mixed feeds is concentrated in those areas, and second, imported ingredients enter the country through Manila ports. This, however results in higher transport costs for domestically produced substitute ingredients, which have to come from regions to the south.[12]

Fifty-one percent of total capacity or 68 percent of actual production is controlled by the 11 large producers, all of whom are members of the Philippine Association of Feed Millers Incorporated (PAFMI). The biggest 5 of these 11 companies are integrators; they are engaged not only in manufacturing and marketing mixed feeds, but also in producing, processing, and marketing livestock products.[13]

Mixed feed production showed an increasing trend from the 1970s to the early 1980s but started to fall in 1984 and 1985, apparently because of the decline in demand (Table 23). Livestock raisers started to decrease their inventory of animals (especially hogs and chicken) in 1984 because of the economic crunch brought about by the devaluation of the peso in late 1983, at which time the prices of vital ingredients such as corn started to shoot up quickly.

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[12]Given the inefficiencies in domestic transportation, domestically produced ingredients usually turn out to be more expensive. It is more costly to transport them to Manila from the southern islands (such as Mindanao), where most of them are produced, than from foreign ports such as Bangkok.

[13]R. Zamora and A. Ladores, "The Animal Feed Industry," Journal of Agricultural Economics and Development 15 (January and July 1985).

Table 22--Distribution of commercial feedmills, by region, 1985

Region	Number of Registered Feedmills	Total Production Capacity
		(1,000 metric tons)
1. Ilocos	3	6.5
2. Cagayan Valley	2	16.5
3. Central Luzon	22	343.8
4. Southern Tagalog	17	255.5
4A. National Capital Region (Metro Manila)	42	525.4
5. Bicol	5	9.2
6. Western Visayas	2	6.2
7. Central Visayas	12	283.9
8. Eastern Visayas	2	3.1
9. Western Mindanao	5	5.6
10. Northern Mindanao	4	54.6
11. Southern Mindanao	5	12.5
12. Central Mindanao	2	3.1
Total	123	1,525.9

Source: Philippines, Bureau of Animal Husbandry, Animal Feed Control Division, unpublished data.

Note: Total production capacity assumes 8-hour shifts and 26 working days per month

Table 23--Total production of mixed feed by feedmillers' associations, 1978-85

Year	Philippine Association of Feedmillers	Central Luzon Feedmillers Association	Metro-Manila Feedmillers Association	Small and Medium-Scale Feedmillers Association	Independent Feedmillers	Total
			(metric tons)			
1978	623,094	40,986	30,892	...	183,278	878,250
1979	631,423	41,393	29,412	...	187,255	889,483
1980	658,748	52,398	34,314	55,549	145,967	946,976
1981	709,383	52,025	39,737	63,697	168,260	1,033,102
1982	767,863	51,474	45,279	74,349	233,949	1,172,914
1983	758,194	49,927	55,834	58,675	222,080	1,144,710
1984	701,754	45,560	57,476	44,848	154,926	1,004,564
1985	518,583	45,061	44,759	52,382	164,806	825,591

Source: Philippines, Bureau of Animal Husbandry, Animal Feed Control Division, unpublished data.

It will be noted from Table 24 that in 1985 about 59 percent of the total mixed feed production was for poultry, 39 percent was for swine, and the rest were for cattle and other animals. Data show that in producing those animal feeds, manufacturers relied mostly on corn and its by-products for energy and on imported soybean meal and fish meal for protein. In a study of the feedmill industry for example, it was found that corn and its by-products comprised around 34 percent of the total feed mixture in broiler and hog feeds (see Table 25). There was a preference for corn, particularly the yellow variety because of its yellow pigment, which gives color to egg yolks and broiler meat.

Table 24--Volume of mixed feed production by type, 1977-86

Year	Poultry	Swine	Cattle	Horse	Others[a]	Total
			(metric tons)			
1977	536,769	211,884	4,623	3,594	7	756,877
1978	603,155	262,483	4,655	3,708	4,249	878,250
1979	608,533	264,147	7,953	3,324	5,526	889,483
1980	648,450	253,226	19,142	3,466	22,692	946,976
1981	695,504	321,083	6,026	3,386	7,103	1,033,102
1982	785,546	364,421	9,030	3,261	10,656	1,172,914
1983	767,572	363,621	4,441	2,971	6,105	1,144,710
1984	639,338	346,428	3,474	3,686	11,638	1,004,564
1985	484,357	319,449	2,747	3,653	15,385	825,591
Average	641,025	300,749	6,899	3,450	9,262	...

Source: Philippines, Bureau of Animal Husbandry, Animal Feed Control Division, unpublished data.

[a]This includes feed for pigeons, crustaceans, fish, rabbits, ducks, and goats.

Table 25--Proportion of different feed ingredients in hog grower and broiler mash, 1975

Ingredients	Hog Grower Mash	Broiler Mash
	(percent)	
Yellow corn	6.74	25.00
Corn bran	20.00	2.76
Corn grits	4.50	6.00
Corn-germ meal	2.50	...
Soybean meal	3.76	11.50
Copra meal	17.50	10.00
Meat meal	5.26	5.74
Fish meal	1.26	6.74
Ipil-ipil meal (dried Leucaena leaves)	2.50	3.74
Rice bran	19.74	2.50
Vitamins	0.24	0.30
Molasses	4.50	4.50
Pollard (wheat bran)	5.00	8.50
Salt	0.24	...
Sorghum	6.24	12.74
Total	100.00	100.00

Source: Paluszka, Study of the Milling Industry in the Philippines (Manila: Center for Research and Cooperation for the Philippine Association of Feed-millers, 1975).

Studies have shown that the substitutability of cassava for corn ranges from 30 percent in hogs and 15 percent in poultry feeds to as much as 100 percent in broiler mash.[14] In fact a least cost formulation shows that the costs of cassava-based mixed and corn-based feeds are similar (Table 26). However, feed millers have not used cassava extensively in their feed mixing operations. They complain of highly irregular supplies of cassava and high prices of the soybean meal that must be used to supplement the protein of cassava. Increases in the productivity of cassava-sown land and the concomitant decline in the cost of producing cassava, however, can be expected to change this in the future. As mentioned earlier, the trend in the domestic prices of cassava and corn will also favor the increased use of cassava for feeds.

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[14]Mahendra Lohani, "Substitution of Corn by Fortified Cassava Meal in Broiler Ration" (Ph.D. thesis, University of the Philippines, Los Baños, 1987).

Table 26--Effect of substituting cassava for corn in hog rations

Component	Price	Corn-Based Feed	Cassava-Based Feed
	(₱/kilogram)	(percent)	
Corn	3.50	59.74	...
Cassava meal	2.60	...	43.62
Soybean meal	6.00	23.34	30.74
Copra meal	2.00	7.63	12.10
Molasses	2.20	6.00	6.00
Hycaphos	3.00	2.59	2.15
Salt	1.00	0.50	0.50
Vitamin premix	50.00	0.20	0.20
Coconut oil	6.00	...	4.62
Methionine	80.00	...	0.07
		100.00	100.00
Nutrient content			
Crude protein (percent)	...	16.63	16.00
Metabolizable energy (kilocalories/ kilogram)	...	3,000	3,000
Lysine (percent)	...	0.85	1.00
Methionine (percent)	...	0.30	0.30
Cost (₱/kilogram)	...	3.96	3.86

Source: Philippine Council for Agriculture and Resources Research and Development, The Philippines Recommends for Livestock Feed Formulation (Los Banos, Laguna: PCARRD, 1987).

5. PROSPECTS FOR CASSAVA PRODUCTION AND USE

The discussions above indicated that cassava farmers are somewhat averse to fertilizer applications and that cassava is generally less profitable than its closest competitor, given present management and cultural practices. However, because the fertilizer-cassava price ratio has been declining recently, it is reasonable to expect that farmers will apply more fertilizer, thus increasing yield and profits. The entry of more agribusiness firms into contract growing makes this prospect even more probable. It can therefore be expected that growth in cassava production will come from increases in yields as well as area.

The long-run growth of yields per hectare over the past two decades has been low. The entry of agribusiness firms into contract growing and more widespread planting of high-yielding varieties, however, can be expected to increase yields to about 10 tons per hectare by the year 1990. Expected increases in fertilizer applications, on the other hand, will further improve yield to 12 tons per hectare by 2000.

On the basis of past trends, it can be expected that the total area sown with cassava will be 209,000 hectares in 1990 and 270,000 hectares in 2000. Given the corresponding expected yields, total production will be 2.09 million tons in 1990 and 3.24 million tons in 2000 (Table 27).

Table 27--Cassava area, yield, and production, 1961-83 and projections to 1990 and 2000

Year	Area	Yield	Production
	(hectares)	(metric tons/hectare)	(metric tons)
Actual			
1961-70	88,722	6.0	532,332
1971-80	115,467	7.0	808,565
1981	168,923	9.4	1,589,565
1982	175,680	9.0	1,589,120
1983	173,923	6.8	1,182,676
Projected			
1990	208,655	10.0	2,086,550
2000	270,417	12.0	3,245,004

Source: Philippines, Bureau of Agricultural Economics, unpublished data.

PROSPECTS FOR CASSAVA AS FOOD

Population growth in the Philippines is at present 2.7 percent per year--0.4 percent per year lower than the last decade. With the active family planning program of the government, official estimates show that it may fall to about 1.5 percent by 2000. This translates into a population of 62 million in 1990 and 75 million in 2000 from a base population of 53 million in 1984. Barring any drastic change in rural-urban migration, 70 percent of the population will remain in the rural areas (Table 28).

Table 28--Population of urban and rural areas, 1980-85, and projections to 1990 and 2000

Year	Population		Total
	Urban	Rural	
Actual			
1980	16,428	31,889	48,317
1981	16,839	32,687	49,517
1982	17,266	33,517	50,783
1983	17,699	34,356	52,055
1984	18,139	35,212	53,248
1985	18,587	36,081	54,668
Projected			
1990	18,444	43,036	61,480
2000	22,576	52,657	75,224

Source: National Economic and Development Authority, Economic Planning and Research Staff, unpublished data.

The country's gross national product grew at an average rate of 6.4 percent per year during the 1970s but grew at a negative rate in the early 1980s. Among all the sectors in the economy, only agriculture posted a positive growth rate during the bad years of the 1980s (Table 29). This has prompted government planners to put more emphasis on agricultural development in order to attain a faster rate of economic recovery. With agriculture as the lead sector, the GNP is expected to bounce back to its previous growth rate of about 6 percent annually, and per capita income is expected to grow at a rate of about 3 percent per year before the end of the decade (Table 30).

Table 29--Average growth rates of value added by manufacturing, services, and agriculture, 1956-84

Sector	1956-79	1980-81	1981-82	1982-83	1983-84
Manufacturing	6.0	3.4	2.4	2.3	-7.1
Services	4.8	5.0	4.1	-0.3	-2.8
Agriculture	4.0	3.7	3.1	-2.1	2.3

Source: National Economic and Development Authority, Philippine Statistical Yearbook 1985 (Manila: NEDA, 1985).

Table 30--Gross national product per capita, 1961-85

Year	Gross National Product Per Capita	Annual Growth Rate
	(pesos)	(percent)
1961-65	1,192	2.5
1966-70	1,310	1.7
1971-75	1,228	3.6
1976-80	1,806	3.4
1981	1,933	0.9
1982	1,921	-0.5
1983	1,897	-1.2
1984	1,750	-9.1
1985	1,618	-6.1

Source: National Economic and Development Authority, Philippine Statistical Yearbook, 1986 (Manila: NEDA, 1986).

Surveys indicate that average per capita consumption of cassava in the Philippines is 5.5 kilograms per year. However, due to income differences, urban dwellers consume less per capita (1.5 kilograms per year) than rural dwellers (7.3 kilograms per year) (Table 31). The negative income elasticity of demand for cassava further supports this observation (Table 32).

As Table 12 shows, average annual per capita consumption from 1961 to 1983 was 9.66 kilograms. This figure lies between the food consumption survey estimates of the Food and Nutrition Research Institute and those reported in NEDA's food balance sheets. Given the past trend, it can be estimated that the per capita consumption will be 7.78 in 1990 and 7.24 in 2000. With this as the basis, it can be expected that total consumption of cassava as human food will be 478,314 tons in 1990 and 544,822 tons in 2000.

Table 31--Mean per capita consumption of starchy staples, urban and rural areas, 1978

Commodity	Total	Urban Areas	Rural Areas
	(kilograms/year)		
Rice	109.5	93.1	117.9
Corn	13.9	6.6	17.9
Cassava and cassava products	5.5	1.5	7.3
Sweet potatoes	5.1	3.3	6.2

Source: Food and Nutrition Research Institute, First Nationwide Nutrition Survey Summary Report (Los Baños: FNRI, 1978).

Note: They are as they were available in the kitchen, including inedible and edible waste.

Table 32--Estimates of income elasticities of per capita consumption of cereals and roots, 1978

Commodity	Income Elasticity of Consumption
Cereals and cereal products	-0.01
Rice	0.09
Rice products	0.09
Corn	-0.19
Other cereal products	0.42
Starchy roots and tubers	0.02
Potatoes and potato products	0.09
Cassava and cassava products	-0.08
Others	0.02

Sources: Food and Nutrition Research Institute, First Nationwide Nutrition Survey Summary Report (Los Baños: FNRI, 1978) as seen in M. B. Binongo, "An Economic Analysis of the Demand for Fresh Cassava and Cassava Products in the Philippines" (M.S. thesis, University of the Philippines, Los Baños, 1985).

PROSPECTS FOR CASSAVA UTILIZATION AS FEED

There are two ways of looking at the prospects for cassava used as feeds. The first and more direct way is to note that the Philippines has traditionally been an importer of corn. As shown in Table 17, corn imports increased in geometric proportion through 1984, and in the period 1980-84, they averaged about 311,000 tons per year. In the context of the present government policy of banning corn imports, this represents an additional ready market of about 1.7 million metric tons of cassava (in fresh root equivalent).

The second approach is to look at the future livestock output and then estimate total demand for cassava feed based on alternative rates of corn-cassava substitution. This is done in Table 33.

Table 33--Projected demand for cassava as feed, 1990 and 2000

Livestock Product/Year	Output	Required Mixed Feeds[a]	Corn Required[b]	Cassava Substitute (Dry)[c]	High Substitution Ratio[c]	Lower Substitution Ratio[d]
	(metric tons)				(metric tons of fresh root equivalent)	
Pork						
1990	938,979	3,286,426	788,742	236,623	1,314,570	876,380
2000	1,521,146	5,324,011	1,277,763	383,329	2,129,604	1,419,737
Poultry meat						
1990	513,820	1,207,477	289,794	43,469	241,495	160,997
2000	1,150,957	2,704,749	649,140	97,371	540,950	360,633
Eggs						
1990	298,483	746,208	179,090	26,863	149,242	99,494
2000	429,816	1,074,540	257,890	38,683	214,908	143,272
Total						
1990	...	...	...	...	1,705,307	1,136,871
2000	...	...	...	...	2,885,462	1,923,642

Sources: See Table 16. Basic data are from National Economic and Development Authority, Food Balance Sheets (Manila: NEDA, various issues 1961-82). Data are derived based on the assumptions below:

[a]The feed conversion rates used were 2.35 for poultry meat and 2.50 for eggs.
[b]The proportion of corn to feed mixture is 40 percent; 60 percent of total output is corn-fed
[c]The corn-cassava substitution rates assumed were 30 percent for pork and 15 percent for poultry meat and eggs.
[d]The corn-cassava substitution rates assumed were 20 percent for pork and 10 percent for poultry meat and eggs.

In 1990, pork, chicken meat, and egg production are projected to be 939,000 tons, 514,000 tons, and 298,000 tons, respectively. In the year 2000, production of pork is projected to be 1.52 million tons, chicken 1.15 million tons and eggs 430,000 tons. Since these animals are highly dependent on corn, they are expected to be the heavy eaters of cassava feed in the future. The projections on the demand for cassava as feed made here, using existing feed conversion efficiency rates. will be based mainly on the projected output of these two groups of monogastric animals. It will be assumed that, for two reasons, relative prices will be favorable for the higher use of cassava as feeds. First, the improvement in cassava yields will result in lower cassava prices, and secondly, the recent decision of the government to ban imports will raise the price of corn relative to cassava. Furthermore, it will also be assumed that, due to the predominance of backyard producers using indigenous feeds such as rice bran, 60 percent of the total output will be corn-fed.

Although studies suggest that cassava-corn substitutability can be as high as 100 percent, a more conservative estimate will be assumed.[15] This is because feed mixers seem to have a high preference for yellow corn. For this reason, two estimates are presented in Table 33. One gives estimates under high corn-cassava substitution ratios of 30 percent for pork and 15 percent for poultry. The other gives estimates under a lower substitution rates of 20 percent for pork and 10 percent for poultry.

Given these assumptions, total demand for cassava as feed is projected to be 1.7 million tons in 1990 and 2.9 million tons in 2000 under the high corn-cassava substitution ratio and 1.1 million tons in 1990 and 1.9 million tons in 2000 under the lower substitution ratio.

PROSPECTS FOR CASSAVA IN OTHER MANUFACTURING USES

Among the other uses of cassava, starch production appears to offer the best prospect. The confidence of foreign investors as well as local in this area is evidenced by the recent entry of a new foreign starch manufacturer into the business. Future demand for cassava starch is expected to be bright for two reasons: the long-run trend in the domestic price of cassava starch relative to corn starch is declining (see Table 10), and demand for manufacturing products like corrugated paper, glucose, and so forth, from which demand for cassava is derived, is expected to increase due to a rebound in the growth of GNP.

Based on the past years' growth of cassava use for the manufacturing sector, it is projected that in 1990, about 731,000 metric tons

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[15]Ibid., and Philippine Council for Agriculture and Resources Research and Development, The Philippines Recommends for Livestock Feed Formulation (Los Baños: PCARRD, 1986).

will be required and in 2000, 841,000 tons. Most of this will be in cassava starch production.

PROJECTED CASSAVA SUPPLY-DEMAND BALANCE

The major source of growth in demand for cassava will be feed manufacturing in 1990 and 2000 (Table 34). From an average of 371,000 tons in 1981-83, feed demand is expected to increase to between 1.1 and 1.7 million tons in 1990 and between 1.9 and 2.9 million tons in 2000.

Consequently, total cassava demand will increase from an average of 1.4 million tons in 1981-83 to between 2.3 and 2.7 million tons in 1990 and between 3.3 and 4.3 million tons in 2000. Deficits are likely to occur, mainly because of the phenomenal increase in feed demand. Although the numbers presented are purely indicative, they nonetheless show favorable prospects for cassava, especially as feeds.

Table 34--Cassava supply and use, 1961-83 and projections to 1990 and 2000

Year	Total Production	Domestic Use			Total Use	Balance
		Food	Manufacturing[a]	Feed		
Actual						
1961-70	529,575	361,215	109,886	61,279	532,380	-2,805
1971-80	841,476	364,607	316,666	169,278	850,551	-9,075
1981	1,589,565	417,285	837,848	336,641	1,591,774	-2,209
1982	1,581,120	416,362	778,493	387,056	1,581,991	-791
1983	1,182,676	413,153	369,231	391,030	1,173,414	9,262
Projected						
1990	2,086,550	478,314	731,352	1,705,307[b]	2,914,973[d]	-828,423[d]
				1,136,871[c]	2,346,537[e]	-259,987[e]
2000	3,245,004	544,622	841,055	2,885,462[b]	4,271,139[d]	-1,026,135[d]
				1,923,642[c]	3,309,319[e]	-64,315[e]

Source: For actual supply and use, see Table 8.

[a]In projecting demand for cassava in manufacturing, an average annual growth rate of 1.5 percent was used. This excludes abnormal growth rates exhibited during 1965 and 1976.
[b]The corn-cassava substitution rates assumed were 30 percent for pork and 15 percent for poultry meat and eggs.
[c]The corn-cassava substitution rates assumed were 20 percent for pork and 10 percent for poultry meat and eggs.
[d]This estimate includes feed use with high rates of corn-cassava substitution assumed (30 percent for pork and 15 percent for poultry and eggs.)
[e]This estimate includes feed use with low rates of corn-cassava substitution assumed (20 percent for pork and 10 percent for poultry and eggs.)

6. CONCLUSIONS

Cassava, compared to other agricultural food crops, is a small part of the total agricultural sector. It occupies 3 percent of the total food crop area and has contributed an average of 10 percent to the value of food crop production. The number of farmers producing cassava is likewise smaller than those producing other crops.

In terms of its contribution to the family's income, studies show that cassava contributes less than other root crops to gross family income.[16] Cereal crops such as rice, corn and sorghum contribute the most to family income.[17]

The relatively low profitability of cassava production has relegated this crop to being a subsistence crop grown on a small scale rather than as a major source of cash income for the family. Except in a few cases where contract growing with starch manufacturers is practiced, cassava is a backyard crop. The management techniques employed have been traditional in nature, with practically no fertilizer or chemicals applied, resulting in low average yields. It has also been used mainly as a human food in rural areas.

Recent developments in the domestic economy are expected to change the picture for cassava in the future. The government's decision to ban corn imports and the declining trend in the fertilizer-cassava price ratio are expected to complement each other, improving the future prospects of cassava. Furthermore, the corn import ban will make the price of cassava more favorable relative to the price of corn. This will increase the demand for cassava as feed. With a declining fertilizer-cassava price ratio, yields per hectare are expected to increase, as farmers will be encouraged to apply fertilizer. Both these developments will lower the per unit costs of production and raise farmers' profits.

Yields are projected to increase to 10 tons per hectare by 1990. This increase will probably occur, due to the increasing popularity of contract growing. This prospect will also be enhanced as planting materials of the high-yielding varieties become more available. In

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[16] L. B. Ponce and B. B. Reoma, "Levels of Participation among Family Members in Making Decisions and in Work Involvement in Small-scale Root Crop Production and Processing," Visayas State College of Agriculture, Baybay, Leyte, 1986.

[17] Gonzales, "Price and Investment Policies for Food Crop Sector Growth."

2000, it can be expected that better management practices (improved varieties and fertilization), will increase yields further to 12 tons per hectare. Given the trend in area planted to cassava, it can be projected that total cassava production will be 2.09 million tons in 1990 and 3.24 million tons in 2000.

On the demand side, it can be expected that the greatest prospect for cassava will come from feed use. Pork, chicken meat, and egg production will increase and the price of cassava relative to corn will decline as the cost of cassava production falls. The upward pressure on the domestic price of corn due to nontariff barriers to corn inputs will reinforce that expectation. Demand for cassava as food and for processing will also increase, but not as much as the demand for cassava as feed.

By 1990, the demand for cassava as food will be 478,000 tons and for manufacture, 731,000 tons. For feed, the high estimate shows a demand of 1.7 million tons, while the low estimate shows a demand of 1.1 million tons, making a total demand of 2.9 million tons on the high side and 2.3 million tons on the low side. In 2000, demand for cassava as food is projected to be 545,000 tons and in manufacturing 841,000 tons. For feed, the high estimate of demand in 2000 is 2.9 million tons and the low estimate is 1.9 million tons, making a total demand of 4.3 million tons on the high side and 3.3 million tons on the low side. Based on these figures, the prospects for cassava within the domestic economy are favorable.

To realize these possibilities, however, the government needs to strengthen support services such as market information, extension, and credit. It should build the necessary infrastructure such as roads to improve the efficiency of moving outputs from the production centers to the feedmill sites in Manila. This will redound to the increase in efficiency of producing, assembling, and marketing the cassava produced by small-farm operators, thereby decreasing their per unit cost of production.

In the context of the present difficulty in producing enough feedstuffs, particularly corn, renewed efforts to exploit the potential of cassava as feed must be strengthened. Scientists interviewed attest that high-yielding varieties of cassava that produce as much as 50 tons per hectare are now available, but that there is at present a shortage of planting materials. A government move to multiply these materials and disseminate them to farmers will go a long way toward increasing productivity. In addition to this, the present policy of liberalizing fertilizer trade should continue in order to maintain the present favorable price of fertilizers. Together, these policies will help in the successful exploitation of cassava's potential for food manufacture and feed.

APPENDIX 1

SAMPLE CONTRACT BETWEEN CASSAVA FARMERS AND STARCH MANUFACTURER

KNOW ALL MEN BY THESE PRESENTS:

This AGREEMENT made and executed by and between:

UNIVERSAL STARCH INDUSTRIAL CORPORATION, a domestic corporation duly organized and existing under and by virtue of the laws of the Republic of the Philippines, with its principal office and place of business at the 9th Floor, Ramon Magsaysay Center, 1680 Roxas Blvd., Metro Manila, with plant and plantation site at Barangay Binicuil, Kabankalan, Negros Occidental, Philippines, represented by---------- ---------- in his capacity as---------- hereinafter referred to as the MILLER;

-and-

---------- Filipino, of legal age, single/married and a resident of ----------, hereinafter referred to as the GROWER.

W I T N E S S E T H :

WHEREAS, the MILLER owns and operates a cassava processing factory for the manufacture of starch and glucose at Barangay Binicuil, Kabankalan, Negros Occidental;

WHEREAS, the GROWER is involved in cassava tubers production, cultivating a total farm area of ---------- (----------) hectares located at ----------, which is (--------) kilometers away from the MILLER's plantsite;

WHEREAS, the GROWER agrees to plant cassava at the above mentioned property and to sell his cassava produce to the MILLER.

NOW THEREFORE, for and in consideration of the premises above stated, the cassava tubers produced by the GROWER are subject to the following terms and conditions:

1. The MILLER shall provide the GROWER technical assistance in his cassava plantation and shall set forth a planting and harvesting schedule for the GROWER.

2. The GROWER obligates himself/herself to strictly adhere to the schedule of planting and harvesting set forth by the MILLER.

3. The MILLER shall purchase all the cassava produced by the GROWER at a guaranteed price of not less than ₱400.00 per ton, delivered by the GROWER at a buying station designated by the MILLER near the plantation of the GROWER.

4. The GROWER agrees to deliver cassava tubers with the standard size of not less than 1.5 inches in diameter at the largest portion. The MILLER shall accept and allow tubers with substandard sizes provided they shall not exceed twenty percent (20%) of the total weight/volume, a tare of 3 to 5 percent shall be correspondingly deducted from said total weight/volume.

5. The GROWER shall deliver cassava tubers to the MILLER which have been thoroughly cleaned, free of mud and stems. In the event that the GROWER cannot meet this requirement, a corresponding tare or deduction shall be imposed by the MILLER.

6. The GROWER is obliged to give prior notice to the MILLER of his scheduled harvest for the determination of the age sizes of the cassava tubers and the schedule of delivery and hauling. Upon the approval of the MILLER, the GROWER shall harvest his cassava tubers and deliver his produce to the MILLER within 24 hours from the time of said harvest.

7. The GROWER shall have the option of utilizing the MILLER's truck to haul his/her cassava tubers produce if his/her farm is within 30 kilometers radius away from the MILLER's plantsite. However, if the GROWER chooses to use his own trucking facilities, he may avail the use of the MILLER's trucking incentives by informing the MILLER in writing of his choice and by signing a copy of a hauling contract one (1) week before harvest date.

8. The GROWER is obliged to deliver his/her cassava produce to the MILLER's plantsite if his/her farm is over and above the 30 kilometers radius as set forth in Condition Number 7 above.

9. The MILLER is obligated to pay for all the harvested cassava tubers of the GROWER that are at the stage of fermentation due to the failure of the MILLER's truck/s to haul said cassava tubers on the date specifically scheduled by the MILLER or any of its authorized personnel.

10. The GROWER agrees to give the MILLER the first option to acquire from the former's plantation all the excess planting materials free of charge for the purpose of the latter's propagation program.

11. The MILLER warrants full payment of the GROWER's cassava production immediately upon the delivery thereof.

12. The GROWER shall allow the MILLER or its representatives to survey, inspect, and conduct tests on his/her plantation from time to time.

13. The terms of this AGREEMENT shall remain effective from ----------, 19----- to ----------, 19----- or a period of ----years.

IN WITNESS WHEREOF, we hereunto set our hands this ------ day of ----------, 19---- at the Municipality of Kabankalan, Negros Occidental, Philippines.

UNIVERSAL STARCH INDUSTRIAL CORPORATION
MILLER

---------- ----------
GROWER

SIGNED IN THE PRESENCE OF:

BY: ---------- ----------

REPUBLIC OF THE PHILIPPINES

---------- s.s.

BEFORE ME, this ----- day of ----------, 19 ----,

at ---------- personally appeared the following persons with their respective Residence Certificate Numbers, to wit:

---------- A- ---------- At ---------- On---------

---------- A- ---------- At ---------- On---------

both known to me and known to be the same persons who executed the foregoing instrument and they acknowledged that the same is their own free and voluntary act and deed.

WITNESS MY HAND AND SEAL on the date and place first written above.

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APPENDIX 2

INCENTIVES TO STARCH MANUFACTURERS

Incentives granted to cassava starch manufacturers being preferred pioneer/nonpioneer enterprise by virtue of Presidenti Decree NO. 1789:

1. Deduction of organization and preoperating expenses.
2. Accelerated depreciation.
3. Net operating loss carryover.
4. Tax exemption on imported capital equipment.
5. Tax credit on domestic capital equipment.
6. Tax credit for withholding tax on interest.
7. Incentives for necessary and major infrastructure and public facilities.
8. Employment of foreign nationals.
9. Deduction from expansion reinvestment.
10. Antidumping protection.
11. Protection from government competition.
12. Deduction of labor training expenses.
13. Protection of patents and other proprietary rights.

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