POTENTIAL SUPPLY OF AND DEMAND FOR CASSAVA IN THE '70's AND '80's

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SUMMARY

Three markets for cassava can be identified: the human food, the industrial starch, and the animal feed markets. The first and third are the most important and receive consideration. Supply of and demand for cassava are projected to 1980. The resulting figures are compared. If all residual production in producing countries was directed towards Europe, supply might well exceed demand. Nevertheless, there is scope for cassava as a diversification crop. Its import-saving ability has important implications for freeing LDC resources for other uses.

RESUME

Les marchés du manioc peuvent être répartis en trois secteurs: l'alimentation de la population, l'amidon industriel et l'alimentation de bétail. Le premier et le troisième secteur sont les plus importants et dignes d'intérêt. Une estimation de l'offre et de la demande en manioc pour l'an 1980 a été présentée, et les chiffres qui en ont resulté ont été comparés. Si toute la production en reste dans les pays producteurs était dirigée vers l'Europe, l'offre pourrait dépasser la demande. Toutefois, le manioc est une culture dont les produits peuvent être diversifiés. Le fait qu'on peut en produire suffisamment pour ne pas avoir à en importer a des implications importantes dans les pays moins développés pusque cela permet de dégager des ressources en faveur d'autres secteurs.

RESUMEN

Se pueden identificar tres mercados para yuca: el de la almantación humana, el de almidón industrial y el de alimentos para ganado. El primero y el tercero son los más importantes y reciben consideración. Se proyectan la oferta y la demanda de yuca hasta 1980. Se comparan los cálculos resultantes. Si toda la producción residual en los países productores, se dirigiera hacia Europa, la oferta bien podría superar a la demanda. No obstante, existe un panorama para yuca como un culativo para la diversificación. Su habilidad para evitar importaciones tiene importantes implicaciones para liberar recursos LDC para otros usos.

INTRODUCTION

Cassava, manioc, tapioca, manidoca and yuca are common regional names of the shrubby perennial tropical root crop *Manihot esculenta* Crantz. Cassava is thought to have originated in tropical Brazil, from where it spread to other parts of Latin America (archeologists have found traces of cassava dating as early as 800 BC on the Colombia-Venezuela border[12]) and in post-Columbian times, to other regions of the tropics.

Today cassava is successfully grown between latitudes 30° north and south and at elevations of up to 2,000 metres (6,500 ft); it is tolerant of temperatures of 18°C (65°F) to 35°C (85°F), precipitation of 50 to 500 millimetres (20–200 ins)[8] and soils with pH from 5–9[11].

This ecological zone or 'cassava belt' coincides roughly with FAO Economic Class 2, or less developed countries (LDCs). This belt accounts for 46% of world arable land, 47% of world population, but provides only 13% of world Gross Domestic Product[2,6].

Cassava production amounts to 57% of tropical root and tuber production while utilizing only 54% of tropical root and tuber acreage[6]. The crop's pre-eminence in less developed tropical countries is explained by its ecological adaptability and its appropriateness to the agricultural conditions of the Cassava Belt. The main attributes which favour the production of cassava are:

1. It is easily propagated – seeds or roots are not required, propagation being a simple matter of planting stalk cuttings.
2. It is relatively high yielding.
3. It is relatively inexpensive to produce since it is easily planted and harvested and requires little or no weeding because of its leafy canopy; it does not have a critical planting or harvesting time, and hence, is r[illegible] season bound.

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4. It is a good risk aversion crop. Its cyanide content makes it subject to minimal animal and pest attacks; it is capable of growing on soils often considered too poor for other crops.
5. It is a reliable staple and an excellent producer of carbohydrates.*

The economic implications of these attributes are many. The farmer can plant and harvest cassava at times when the opportunity cost of his labour is very low (or zero), and, given that labour is the major input, the production of cassava enables the farmer to increase his income. The plant's tolerance to drought and pests makes it a very suitable risk and famine aversion crop. As a human food, cassava has been criticized for its low protein content; on the other hand, cassava produces more carbohydrate per unit area than any other widely cultivated crop, and since it has been projected that by 1980 there may be a carbohydrate rather than a protein shortage in many tropical regions[1], the importance of cassava in the human diet in LDCs cannot be overlooked. Thus, cassava is an attractive staple for subsistence farmers, and given favourable market conditions could have potential as a diversification crop. In most regions of the tropics the major proportion of cassava produced is domestically consumed (Africa 73.8%, Latin America 48.5%; the Far East 81.6%;* in the past decade, however, an increasing share of cassava production has been traded internationally. The future of cassava as a crop for economic diversification depends greatly upon whether or not this trade will increase.

This study takes as its point of departure the present very interesting situation in which conventional wisdoms regarding cassava are confronted by emerging markets, new contexts and reassessments. The situation is economically and politically interesting because it, of necessity, invokes (hopefully accurate) speculation on future trends of cassava production and marketing. Most important, the situation is humanly interesting because it involves the food source and livelihood of many millions of people living within the Cassava Belt.

Three distinct markets for cassava can conveniently be identified: the human food market; the industrial starch market, and the animal feed market. It is the future of the first and last markets which are considered in this brief paper.**

CASSAVA IN THE HUMAN FOOD MARKET

Cassava is well known as an important dietary staple in many parts of the tropics, with Zaire reported to be the country with the highest per capita consumption rate (1193 calories/day, or 58.5% of calorie requirements[9]. At the more aggregative level, cassava is found to provide 38% of the calories required in Africa; 12% in Latin America, and 7% in the Far East. Thus cassava may provide 146 million people in the tropics with half of their calorie requirements.

Future demand for cassava will be determined by future population, income and prices. Of these factors, the first two are considered to be the most important (as well as being relatively more easy to predict). The functional relationship between demand, population and income is expressed in equation 1.

$$D_{cjt} = [d_{cjo} + n_j (\ddagger Y/Y_{jo}] \; P_{jt} \qquad (1)$$

where

D_{cjt} = demand for cassava at time t;
d_{cjo} = per capita consumption at the initial time period;
n_j = income demand elasticity* for cassava;
$\ddagger Y$ = change in per capita income between time t and o;
Y_{jo} = per capita income at the original time period;
P_{jt} = population at time 5
j = signifies data referring to the jth country
c = signifies cassava.

Substituting 1980 projections of population and income into this model produces the following estimates of 1980 human demand for cassava (Table 1).

These projections represent at least a 25% increase in demand in the seventies. If the projected demand levels are realized, cassava could provide 37% of the calorie requirements of Africa; 11% in Latin America; and 6% in the Far East; thus cassava may provide more than 500 million people in the tropics with more

*Coursey and Haynes[4] p. 265 have calculated the production of kilo-calories/hectare/day (khd) of some major crops to be: cassava, 250 khd; maize, 200 khd, rice, 176 khd: sorghum, 114 khd; and wheat, 110 khd.

* Correspondences with the Commodity and Trade Divisions of the Food and Agriculture Organization, Rome, 1972.
**Presently the industrial starch market, located primarily in Canada, Japan, and the United States, accounts for less than 1% of total demand for cassava and cassava products; and whilst this market will probably grow, there is little evidence that its relative importance will increase[10]

*Of the 78 tropical countries for which income demand elasticities are available, 57% are positive, implying that as income increases so will demand for cassava[10] .

than half their daily calorie requirements. Clearly the future of the human market in volume terms is promising.

CASSAVA IN THE ANIMAL FEED MARKET

The growth of this market coincides with the development of the EEC's Common Agricultural Policy (CAP) which altered the relativity of livestock feed energy and protein prices, making it attractive to use large quantities of relatively cheap protein and energy sources (*viz.* soybean meal and cassava respectively) rather than cereals in the production of compound feeds, – in short, 'fabricating' from an appropriate mix of soyabean and cassava a product superior in quality to maize. The increased demand for livestock products which led to increased demand for compound feeds, increased dependence on mixed feeds in livestock rearing, and increased livestock production. Only small quantities of cassava were traded prior to the initiation of the CAP in the early 'sixties. Prior to 1969, the bulk of cassava exports was in the form of meal and chips, but within a matter of two years cassava pellets captured 90% of the market. The bulk of cassava imported into Europe comes from Thailand, which increased exports from 280,000 tons in 1962 to approximately 1,480,000 tons in 1973[3]. Obviously, other exporting countries have not experienced such large absolute increases, but their potential to increase exports has evidently always existed.

An important factor in the growth of Thai exports is the fact that cassava is an insignificant component in the Thai diet, and thus is considered by Thai growers to be a cash crop with realizable cash returns. Thai exports have also benefited from foreign investment, initially in the form of two German pelleting plants, followed by the establishment of other large commercial plants (at present 7). In most other producing countries (especially in Africa and South America) human consumption of cassava is of primary importance, with the price of domestic products often yielding greater returns than produce for export markets (*viz.*, in Brazil, farinha de mandioca, consumed at table, costs approximately $100.00/ton, while cassava pellets for export sell at best at $60.00/ton f.o.b. Brazil. Despite these pressures from domestic demand the export market is now worth approximately $75,000,000 to cassava exporting countries.

As in the past, future demand for cassava in the EEC is a function of demand for livestock products, the total demand for concentrate feeds, and price. Recent studies[5,7] predict that demand for livestock products will increase, and that higher percentages of compound feeds will be used in livestock production. The two studies cited indicate that higher incomes, greater demand for livestock products, and increased dependency of compound feeds will lead to a substantial increase in the demand for compound feeds (Table 3). Largest expansion in the use of concentrate feeds is expected to occur in France and Italy, since these two countries use relatively low levels of compound feeds at present.

Projections of the share of this expanded compound feed market which will be captured by cassava imports have been estimated by the evaluation of least-cost feed rations. This analysis entailed collecting data on feed ingredient prices and compound feed specifications (i.e., starch equivalent, metabolizable energy, crude protein, lysine, methionine, etc. requirements for various categories of feed) in EEC countries. The least-cost feed rations were estimated by means of linear programming. From these formulations it was possible to determine the percentage of cassava in each ration, given various price relativities. For simple projection purposes, it is possible to multipy cassava percentages by the appropriate demand level for compound feed, and then to sum the results to arrive at an estimate of the total demand for cassava in 1980. Symbolically the calculation is as follows:

$$D_{c,80} = \sum_{i=1}^{9} \sum_{j=1}^{n} X_{i,j} c_{i,j} \qquad (2)$$

where

$D_{c,80}$ = demand for cassava in 1980;
X = demand for compound feed;
$C_{i,j}$ = percentage of cassava in the ration;
i = the ith country in the EEC;
j = the jth type of feed.

However, for the projections presented in this paper, Equation 2 was modified to comply with the following country-specific constraints:

1. Only feed compounded in the Northern part of Germany will use cassava (approximately 60% of total compound production.)
2. Belgium and Luxembourg are assumed to behave similarly and thus are treated as one country.
3. Only very small quantities of cassava will be used in Ireland; therefore this demand has not been included in the final estimations.

These constraints, applied to Equation 2, produced the projection of the demand for cassava in 1980

contained in Table 4. The demand projections for Germany, Belgium-Luxembourg and Holland appear to be a continuation of trends begun in 1963, while the French, Italian, Danish and British demands reflect a break with past trends. The latter two countries, being still relatively free to purchase feed grains at world prices, will probably not use cassava before 1974/75. Hitherto Italy has used only small quantities of cassava, primarily because of a concessionary levy on maize which made it more attractive to use maize than cassava and other energy feeds in feed compounding. This concession is being dismantled. France was not an earlier user of cassava because of the relatively low price of domestic grains. However, in 1972, several large French compounders began using cassava in their rations at about the 15% level. For projection purposes, it has been assumed that this trend will not be reversed.

The accuracy of projected demand for cassava in 1980 (Table 4) hinges on three further assumptions: 1) that the EEC will not introduce barriers to cassava trade; 2) that EEC grain prices are maintained at their present level and 3) that protein prices do not increase too sharply*. (Recall the complementarity between cassava and soybean meal and other protein sources). The first assumption, while speculative, is deduced from several considerations. First, the importation of 8,900,000 tons of cassava is but a small part of total feed imports, and, as such will probably be allowed to enter the EEC at existing levies. Second, cassava comes from developing countries, whom the EEC has declared that they will assist. What better way than to import animal feed? Third, in order to promote the production of livestock, the EEC would like to keep feed prices as low as possible. A complete banning of cassava would increase the per ton cost of feed. The second and third assumptions, also speculative, are based upon best possible information.

Whilst future political exigencies may invalidate these arguments, they presently have currency. Thus, our attention is turned to a brief examination of the projected availability of supply.

SOURCES OF SUPPLY

It was noted in the introduction that a large percentage of cassava production is domestically consumed. In fact, for almost all exporting countries (with the notable exception of Thailand) exports appear to be residual supplies. Therefore, a first approximation of the availability of cassava for export can be derived from a comparison of projected domestic demand for cassava and projected production of cassava (Table 5). The production projections are based upon regression growth models.* The difference between projected demand for and production of cassava is taken as a first approximation of the amount of cassava which will be available for export if export promotion policies are not introduced. The implications of Table 4 are that Africa as a region will have much smaller quantities of cassava for export than the Far East and South America, which can have more than 24,000,000 metric tons of fresh root equivalents to export. Converting the minimum difference between production and demand to animal feed ingredient units (2.5 tons of roots = 1 ton of pellets), suggests that if all residual production is converted to chips and pellets, the supply of cassava for export, 10,287,000 metric tons, is greater than the projected demand for cassava in Europe.

This first approximation, therefore, must temper the emerging awareness on the part of producing countries of the potential for cassava as a diversification crop. In Thailand, the country with the largest realized export capacity, the Ministry of Agriculture is now concluding a lengthy survey of the production and processing conditions for cassava, while the Department of Trade and Business is studying marketing and transporting arrangements. In Brazil and Malaysia studies and programmes providing substantial technical and financial assistance are under way to promote production and export of the crop. Without doubt such efforts will greatly influence the global competition of cassava exports.

CASSAVA AS A DIVERSIFICATION CROP

From the above analysis it can be concluded that there will be a growing demand for cassava products, and that global supply, given past trends, will meet future demand. Therefore, *prima facie*, any producing country which is attracted to cassava as a diversification crop must be prepared to provide cassava products at competitive prices and at suitable quality and quantities. The potential exporter of cassava should realize:

1. That the price of cassava products must be competitive. In the EEC this means a cif Rotterdam price of approximately $75.00/ton.
2. That supplies of cassava must be readily available throughout the year — consumers do not wish to stockpile large quantities of cassava products.

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*Even with a 60% increase in the cost of all high protein ingredients it appears that the low projection could be exceeded[10].

The production equations are:

$$\ln P_j = a_j + b_j 5$$

where P = production of cassava; t = time; j = the jth country.

3. That Thailand may continue to expand exports, and thereby capture an even larger proportion of the European market.
4. That if Brazil can either increase production by a few percentage points or divert a small percentage of production to export markets,* Brazil and Thailand could meet total export demand.

Notwithstanding these reservations, it appears that there is scope for a number of developing countries to now consider cassava as a diversification crop**. Furthermore, the current interest in cassava trade may also highlight the possibilities of promoting cassava because of its potential import-saving ability. The use of cassava as an input to industry and animal rearing instead of other starches or grains, especially those which must be imported, could free LDC resources for more productive uses. Cassava may soon cease to be criticized for what it is not, and become valued for what it is.

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* Note that Brazil produces 30,000,000 tons of cassava a year (25% of world production). Therefore, a 10% increase in output or a similar diversion of production to exports would produce an additional 1,200,000 tons of pellets (35% of the low EEC projection, Table 3)

**The demand for cassava as a feed ingredient may increase dramatically if Japan becomes a user of cassava. Present estimates are that Japan could easily consume 1 million tons of pellets a year once cassava is used in compound animal feeds.

TABLE 1

Projected human demand for cassava;* 1980
(1000 metrins tons)

Region	Low	High**
Latin America	26,353	29,036
Africa	34,727	35,444
Far East	21,154	21,318
TOTAL	82,234	85,798

Source: Truman P.Phillips[10]

* Much of this work was kindly provided by the Commodity and Trade Division of the FAO, Rome, 1972.

** Low projections were derived from the FAO's Second Development Decade growth model, while the high projections reflect a continuation of past trends.

TABLE 2

Imports of cassava products into the European Economic Community
(1962–1970) (1000 metric tons)

	1962	'63	'64	'65	'66	'67	'68	'69	'70	'71	'72	'73
W.Germany	366	387	462	520	702	533	481	548	591	479	387	420
France	23	20	18	17	16	na	na	na	35	79	na	na
Italy	0	0	0	1	0	na	na	na	14	na	na	na
Netherlands	1	5	17	76	96	159	237	444	502	599	650	700
Belgium	23	72	105	100	70	113	127	212	268	278	na	na
TOTAL	413	484	602	714	884	(805)	(845)	(1204)	1410	1750	1850	na

Source: 1962-66 *The markets for manioc as a raw material for compound feedingstuffs.* International Trade Centre, UNCTAD/GATT, Geneva, 1968.

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TABLE 3

Projected EEC demand for commercially compounded feeds: 1980
(1000 metric tons)

	Cattle + calves	Hogs	Poultry	TOTAL
W.Germany	3,550	6,200	4,180	13,930
France	4,250	5,250	4,195	13,695
Italy	2,200	1,300	4,530	8,030
Netherlands	2,550	4,560	2,180	9,290
Belgium/ Luxembourg	1,100	2,475	1,305	4,880
United Kingdom	3,033	3,171	3,965	10,169
Denmark	753	4,461	437	5,651
EEC TOTAL	17,436	27,417	20,792	65,645

Source: 1. W.Esselmann[4] 2. Truman P. Phillips[10]

TABLE 4

Projected EEC demand for cassava: 1980
(1000 metric tons)

	Low	High
Netherlands	1,020	2,380
France	157	1,950
Denmark	558	1,227
Germany	677	1,161
United Kingdom	472	947
Belgium	472	725
Italy	117	577
TOTAL	3,473	8,967

Source: Truman P. Phillips[10]

TABLE 5

Projected human demand for and production of cassava: 1980
(1000 metric tons)

	1980 demand	1980 production	Difference between production and demand
Minimum Difference			
Africa	35,444	37,107	1,663
Latin America	29,036	48,052	19,016
Far East	20,318	26,357	5,039
World	85,798	111,516	25,718
Maximum Difference			
Africa	34,727	37,207	2,480
Latin America	26,353	60,491	34,138
Far East	21,154	29,592	8,438
World	82,234	127,290	45,056

Source: Truman P. Phillips