The world cassava economy

Facts, trends and outlook

IFAD
INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT

Food and Agriculture Organization of the United Nations

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FACTS, TRENDS AND OUTLOOK

FOREWORD

The "World Cassava Economy: Facts, Trends and Outlook" has been prepared by the FAO Commodities and Trade Division in collaboration with the International Fund for Agricultural Development (IFAD). The initiative coincided with the development by IFAD of a "Global Cassava Development Strategy" to which FAO has been closely associated. It is the latest of a series of monographs on basic staple food crops issued by the Division, which already covered sorghum, millet, white maize, potatoes and sweet potatoes. The present document is expected to contribute to a better understanding of the factors underlying changes in the domestic and international markets of cassava and derived products, thereby facilitating the formulation and finalization of IFAD's Global Cassava Development Strategy.

I. SUMMARY AND CONCLUSIONS

Cassava production since the mid-1980s has maintained the momentum it had over the previous decade, but unlike in that period, the expansion has relied on an expansion of plantings rather than on rising productivity. In fact, little improvement in average yields has been achieved since 1983-85 at the world level, which in part reflects a shift of cassava cultivation to marginal lands and incomplete success in disseminating high-yielding varieties and improved production methods among farmers. Moreover, while production growth has been relatively strong in Africa it was modest in Latin America and the Caribbean and in Asia, in sharp contrast with the dynamics of the past decade, when Asia had arisen as the fastest growth producing region. The loss in productivity momentum in the latter region coincided with a slackening of demand, which highlights the importance of stable and remunerative markets to foster a wide-scale adoption of improved production technologies.

While demand of cassava for feed boosted production in the 1970s and early 1980s, food demand has been the principal force underpinning the sector in recent years, with much of the growth concentrated in Africa. On a per caput basis, however, cassava food consumption has risen by less than one percent on average and has even fallen in Latin America and the Caribbean and in Asia where high rates of income growth were achieved. Such a pattern attests to the importance of cassava for low-income consumers but also highlights that the development of new food products through processing has been insufficient to counter the fall in fresh root consumption associated with increasing Incomes and with migration to urban centres.

Demand for cassava as feed did not provide incentives for a strong expansion of the sector in the 1990s, as implementation of the Common Agricultural Policy (CAP) reform prompted a decline in domestic grain prices and, as result, of cassava pellets import prices in the EC. However, although feed cassava products face increasing competition from grains on international markets, cassava feed usage is expanding fast in the main producing countries, in particular in Latin America and the Caribbean and in Asia where income growth is boosting the demand and production of livestock products. The current shift towards grains in animal feeding in the EC has brought about a fall in cassava trade compared with the record levels of access quotas have remained unfilled.

The potential utilization of cassava as an input in manufacturing is far from being tapped in most regions and only Thailand has made progress in developing a well established cassava starch industry to meet domestic and export requirements. Because of the high degree of protection and complexity of the international starch markets, producers of cassava starch may find it more attractive to destinate their products to their domestic markets. This may imply some import substitution for competing products, especially if subsidized by the supplying countries, as is the case of potato starch from the EC. There is also scope for trade in cassava starch to expand since export prices appear to be competitive relative to maize or potato based starches. Thus, further progress in reducing tariff and non-tariff barriers could be become a crucial condition for the fostering of trade in cassava starch and flours in the medium term and a possible target for the forthcoming Round of Multilateral Trade Negotiations.

FAO projections to 2005 point to a sustained growth in production. This is likely to be dominated by a rise in productivity but little change in plantings, as renewed efforts to disseminate the new technologies among farmers gain momentum and bear fruits. This would imply a reversal of current trends in Latin America and the Caribbean and in Asia. Demand for cassava food products is anticipated to remain the leading force underpinning the sector, although much of the growth is likely to parallel a shift of consumption from fresh roots to value-added food products. Cassava feed utilization may recover some of the dynamism lost in the 1980s, under the stimulus of expanding livestock sectors of the producing countries, especially in Africa and in Asia, while continued competition from grains may hinder growth in cassava feed utilization by importing countries. As a result, little change in cassava trade flows, much of which should remain in the form of cassava chips and pellets for the feed industry, is currently projected.

Unlike for other food crops, research on cassava, including biotechnology, has been conducted principally by the public sector. Biotechnology progress has been achieved in the control of pests and diseases and in improving the characteristics of the final cassava products. Biotechnology gives scope for large increases in production and domestic marketing, which alone amply justifies the attention placed on the crop by the public sector research, but its potential impact on trade is uncertain. Since biotechnology research on competing crops is more advanced, these might even displace cassava products on international markets. The impact of the new technologies will depend, to a large extent, on their adaptability to the small farmer conditions, on their effective dissemination on a large

scale and on the acceptability of the genetically modified cassava products to the final consumer.

The above conclusions raise a number of issues:

- As the future expansion of cassava output is likely to depend primarily on productivity increases, these will require the adoption of improved varieties and technologies on a wide-scale. However, in many developing countries, progress in their dissemination and in the production and distribution of improved planting material, including varieties with high starch content and good tolerance to major pests and diseases, remains patchy as does the development of cassava production intensive systems. Thus, for new technologies to be available to farmers, including biotechnology, extension services as well as national and international agricultural research programmes will need to be strengthened.

On the utilization side, bulkiness and perishability of cassava roots, resulting in increased marketing and transport costs, make the product relatively expensive in urban areas, a constraint that could be overcome through the development of processing close to the production centres. Moreover, consumption by urban dwellers could be stimulated through a diversification into new value-added cassava products, such as bread, biscuits, noodles, cakes, baby foods and sweeteners. In many developing countries, the utilisation of cassava as animal feed is limited by the erratic supply and quality of cassava and by competition from alternative feedstuffs, especially grains. Cassava utilization as an industrial input will depend on its availability and price-competitiveness with alternative products such as maize starch in the processing of paper, textiles, Pharmaceuticals, sweeteners, resins, gums, adhesives, etc. Such competition is anticipated to grow in the medium term, which would put increasing pressure on cassava producers and processors to diminish their costs if they wish to expand or even maintain their current shares in domestic and international markets.

- In many developing countries, cassava is thinly traded and/or traded informally. The ack of established marketing channels and poor infrastructure and market information have been among the main factors constraining trade in cassava. Thus, trade could be promoted through the development of local processing, the establishment of market information systems and the promotion of niche-markets for

novel and speciality products, etc. To a large extent, however, the future of trade in cassava products will depend on institutional factors, in particular the policies implemented by the major importers. With the recently agreed measures to reduce domestic prices of grains in the EC, cassava pellets exporters will be urged to find alternative markets or to make supplies available at cheaper prices. At the same time, there is a need to cater for a reduction in international market protection, especially for cassava starch-based products.

- Debate has often centred on whether research on crops such as cassava is better carried out by the private or the public sector and the positive role of collaboration between the two has been highlighted. Although the scope for complementarity has been recognized, it has also been stressed that research should closely involve other stakeholders, especially farmer groups and non-governmental organizations. Such collaboration would hopefully contribute to boost the cassava sector and help it tap its potential in the food, feed and starch markets.

II. INTRODUCTION

The word cassava comes from "casabi", the name given by the Arawaks Indians to the root. It is known as "yuca" in Spanish, "manioc" in French, "mandioc" In Portuguese; "cassave" in Dutch and "maniok" in German. Cassava (Manihot esculenta Crantz) was widely cultivated as a staple crop in pre-Columblan tropical America. Early European traders soon recognised its importance and, in the 16th century, introduced it into Africa. Nowadays, cassava is cultivated in most tropical countries situated in the equatorial belt, between 30° north and 30° south of the equator, which attests to its adaptability to a wide range of ecosystems[1]. Some of the key characteristics of the crop are its efficiency in producing carbohydrate, its tolerance to drought and to impoverished soils, even though it thrives on fertile, sandy-clay soils, and its high flexibility with respect to the timing of planting and harvesting. For these reasons, cassava plays an essential role for food security, especially in those regions prone to drought and with poor soils. It is the world's fourth most important staple after rice, wheat and maize and is an important component in the diet of over one billion people.

It is widely recognized that cassava attributes and potential have generally not received the deserved attention by governments in the 1970s and 1980s, for policies were geared towards boosting the production of cereals, the core of the green revolution. Farmers in Africa revalued the crop after the 1983-85 drought, which severely affected cereals. More recently, in Asia and in South America, cassava has played an important role as a food security crop in the context of cereal shortages arising from El Niño and La Nina weather anomalies in 1997 and 1998. Apart from a lack of institutional support, other factors have hindered the development of the cassava sector worldwide, including the direct competition between cassava and cereals in food consumption, feed and industrial uses. Under the prevailing low international cereal prices, there is considerable pressure for cassava production and processing costs to be reduced if the crop is to retain its comparative position or gain a greater share in the food, feed and industrial markets.

[1] Cassava is adaptable to different types of soil. It is cultivated under temperatures and rainfall conditionsvarying between 10°C and 40°C and between 900 mm and 2000 mm, respectively.

This document includes three sections, a statistical appendix and a methodological annex. The first part examines the recent trends in cassava supply, consumption, international trade and prices. It is followed by a presentation of the results of the FAO cassava medium-term projections to the year 2005. The third section* examines the status of biotechnology developments in cassava and discusses the potential impacts on trade. The statistical appendix, based on FAO data bank, provides a set of historical data on production, utilization, prices and trade and shows the results of the FAO cassava projections to the year 2005 in more detail.

* Based on a study prepared by Prof. John H. Barton

III. WORLD CASSAVA SITUATION AND RECENT TRENDS?

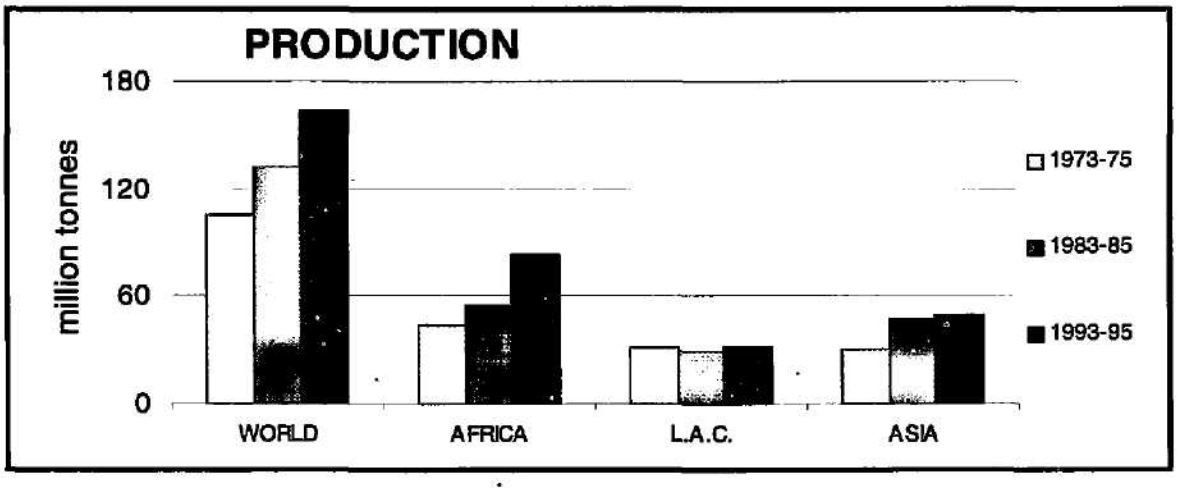
III. 1 Production, area and yields

Almost 70 percent of world cassava **production** are concentrated in five countries, namely Nigeria, Brazil, Thailand, Indonesia and the Congo Democratic Republic. World cassava production increased from 1984* to 1994* at a rate of 2.2 percent a year, the same as in the previous decade (table 1), reaching 164 million tonnes in 1997 or 60 million tonnes more than in 1973-75. That increase relied mostly on an area expansion (1.8 percent a year) while the contribution from yield increases was small (0.4 percent a year).

Table 1. Production [(a)]

	1973-75	1983-85	1993-95	Growth 1973-75 to 1983-85	Growth 1983-85 to 1993-95
	(.....thousand tonnes.....)			(..... Percent per year.....)	
World	105,400	131,424	163,746	2.2	2.2
Africa	43,378	55,207	83,062	2.4	4.2
Latin America and the Caribbean	31,628	28,690	30,804	-1.0	0.7
Asia	30,262	47,371	49,740	4.6	0.5

(a) in root equivalent



[2] The trend analysis covers the 1973-75 to 1993-95 period. Throughout the document, the three year averages are represented by the mid-period year marked with an "*". For instance "1974*"corresponds to the 1973-1975

Much of the rise in global cassava production since the mid-1980s was concentrated in Africa where the sector experienced a real boost. Much slower growth was observed in Asia and in Latin America and the Caribbean over that period, at less than one percent per year. While in the latter region this represented a reversal from a falling trend recorded between 1974* and 1984*, for Asia it contrasted with the vigour that had characterized the sector in that period, when producers were responding to an expanding demand for export.

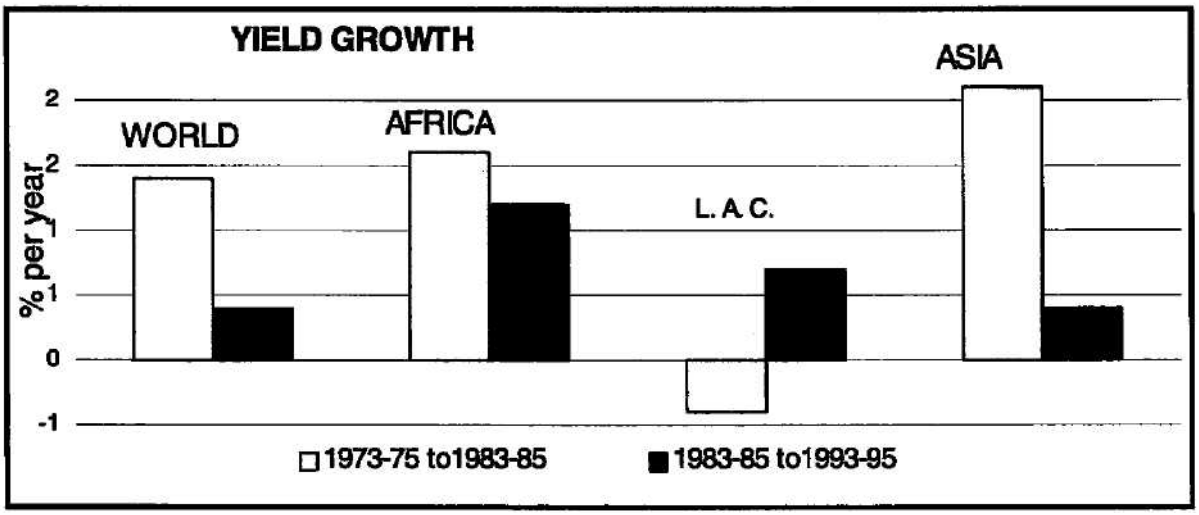
Cassava **yields** vary with cultivars, season of planting, soil type and fertility. With improved varieties and under good management practices, they can reach 20-25 tonnes per hectare. Under the most prevalent farming methods, cassava yields are much lower. In 1994*, they averaged 9.9 tonnes per hectare worldwide, little changed from the 9.5 tonnes per hectare reached in 1984*. Although the productivity is higher in Asia and in Latin America and the Caribbean, yields have shown a tendency to stagnate in the two regions, in contrast with the positive trend observed in Africa, where they remain, nevertheless, low (Table 2). This generally poor performance can be attributed to a series of constraints, including the occurrence of pests and diseases and poor farming practices. Low cassava yields relative to their potential also reflect the influence of subsistence production systems, which are mainly geared to provide a safety net, in case of cereal crop shortfalls. Within a pattern of crop rotation, cassava is also cultivated last in the sequence before fallow[3], when the soil fertility has been greatly depleted. Very often, it is inter-cropped with maize, yams, bananas and legumes. Rarely is cassava cultivated as a mono-culture. Although cassava is commonly recognized as a subsistence crop, there is growing evidence that it is an important cash-earner for most producers and that the marketed share of output often exceeds that of cereals.

Table 2. **Yield** [(a)]

				Growth	
	1973-75	1983-85	1993-95	1973-75 to 1983-85	1983-85 to 1993-95
	(.....tonnes per hectare.....).			(...percent per year...)	
World	8.3	9.5	9.9	1.4	0.4
Africa	6.2	7.3	8.2	1.6	1.2
Latin America and the Caribbean	11.6	11.1	11.9	-0.4	0.7
Asia	10.3	12.7	13.2	2.1	0.4

[(a)] In root equivalent

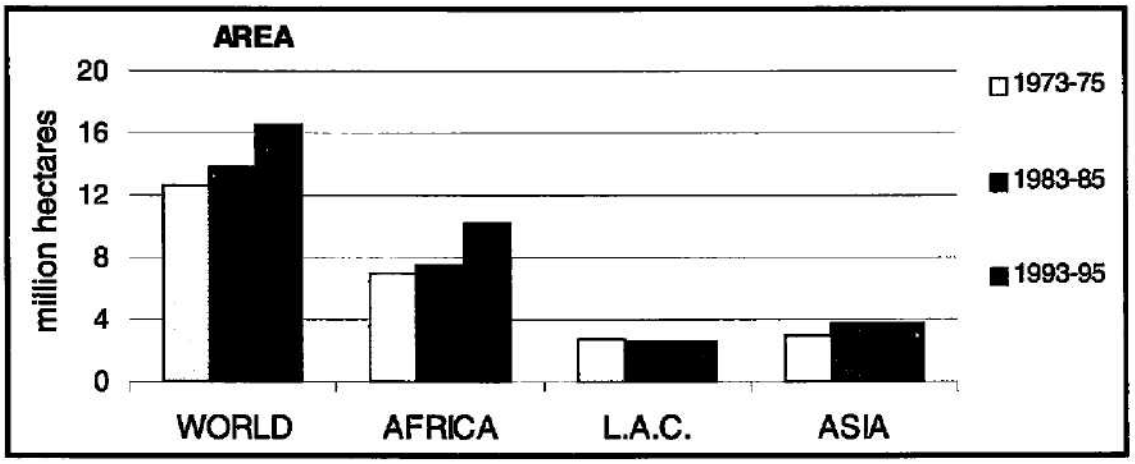
[3] In Ghana, for Instance, the crop sequence in the rotation is usually as follows: maize - cowpea - maize/ cassava - fallow.



The **area** under cassava averaged 12.7 million hectares worldwide in 1974*. Over the following two decades, It rose at an annual rate of 1.3 percent to 16.5 million hectares in 1994* (Table 3). However, growth was more dynamic between 1984* and 1994*, which coincided with a spread of cassava in Africa following the dramatic drought in 1982-83 that led governments and farmers to re-value the crop for its adaptability to adverse growing conditions and for its resistance to drought. In Asia, the pattern of cassava cultivation was different and the area recorded a major increase in the 1970s and early 1980s when cassava gained major export crop status. Its cultivation stagnated thereafter, when the demand for export receded. In Latin America and the Caribbean, the area planted fell in 1974*- 1984*. Over that period, Government policies were mainly designed to promote the expansion of cash crops and cereal production, hereby encouraging a shift away from cassava production. In the following ten years, the contraction in cassava plantings ceased, as Government interventions in agricultural production and marketing diminished.

Table 3. **Area**

				Growth	
	1973-75	1983-85	1993-95	1973-75 to 1983-85	1983-85 to 1993-95
	(.....thousand hectares.....).			.(.....percent per year...)	
World	12.693	13.855	16.450	0.9	1.8
Africa	7,030	7,518	10.158	9.7	3.1
Latin America and the Caribbean	2,722	2,592	2,593	-.0.5	0.0
Asia	2,928	3,730	3.775	2.5	0.1



III.2 Cassava Utilization

Worldwide utilization of cassava increased from 130 million tonnes (in fresh root equivalent) in 1984* to 162 million tonnes in 1994* (Annex Table 3). Food consumption, represented some 58 percent of the total during both periods while the share of feed declined from 28 percent to 25 percent, reflecting a smaller utilization in the EC. The proportion of cassava used as input for processing into industrial products rose from 2 percent to 3 percent between the two periods. Waste was estimated to account for some 19 percent of production both in 1984* and 1994*.

I. Cassava food consumption

Both cassava roots and leaves are suitable for **human consumption.** The first are an important source of carbohydrates and the second, of proteins and minerals. Some cassava roots contain large amounts of cyanohydrin that emanates cyanide, a toxic for human health, and gives the root a bitter taste. Cultivars are accordingly classified as sweet or bitter depending on their cyanide content. Bitter varieties are especially fitted for industrial and feed purposes, because of their higher starch content, while sweet varieties are generally preferred if the root is destinated to be consumed as food. Unlike sweet cassava, bitter cassava is not safe for human consumption unless properly treated. The primitive inhabitants of the Americas knew about cassava toxicity and developed several techniques to remove the cyanide from the bitter cassava by peeling, grating and squeezing the root. The cyanide-free moist cassava pulp was then baked or dried and could be stored for several months. These same techniques are still widely in use in several tropical countries. A typical cassava root is composed of moisture for 70 percent, starch for 24 percent, fibre for 2 percent, protein for 1 percent and other elements for 3 percent. Because of its high water content, the root is bulky and highly perishable, so processing should be carried out within 48 hours of harvest. Thus, processing permits to enhance the value of the product by removing

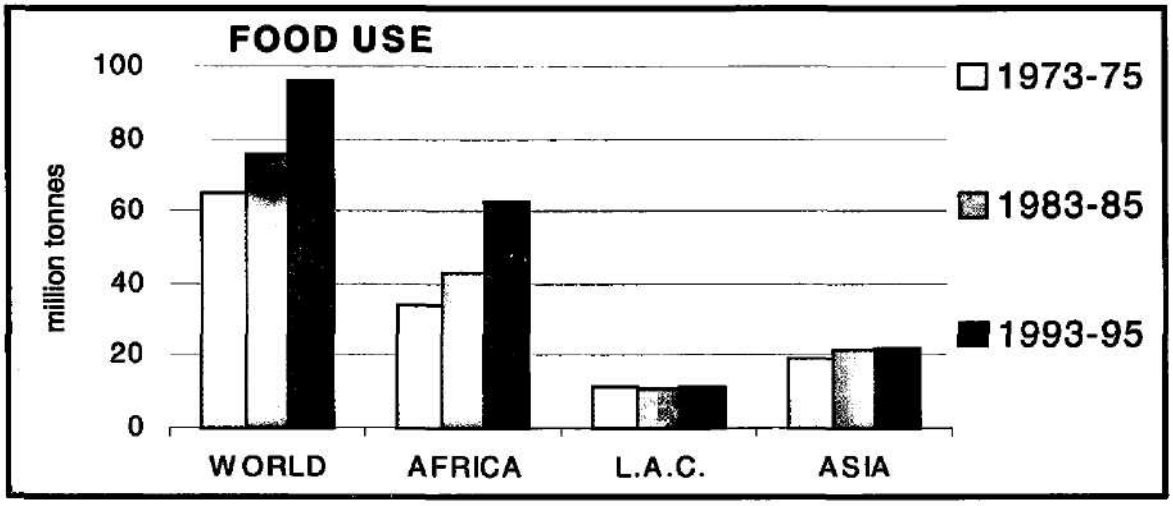
the naturally-occurring toxins found in the root; it reduces the weight of the product, thereby facilitating its transportation to markets; it lessens post-harvest losses arising from breakage of the roots; and extends the product's shelf-life.

Cassava is consumed as food only in the developing countries. Between 1984* and 1994*, total cassava food use rose from 76 million tonnes to 96 million tonnes or 2.4 percent per annum (table 4). This growth was faster than in the previous decade, reflecting a dynamic expansion in Africa, in contrast with the stagnation that characterized cassava food consumption in the other regions.

Table 4. Food Use [(a)]

	1973-75	1983-85	1993-95	Growth 1973-75 to 1963-85	1983-85 to 1993-95
	(.....thousand tonnes .....)			(..... Percent per year...)	
World	64,731	75,737	95,997	1.6	2.4
Developing Countries	64 538	75 607	95 935	1.6	2.4
Africa	33,835	43,133	62,558	2.5	3.8
Latin America and the Caribbean	11,572	10.,787	11,528	-0.7	0.7
Asia	19,044	21,556	21,733	1.2	0.1
Developed	193	130	62	-3.9	-7.1

(al) in root equivalent

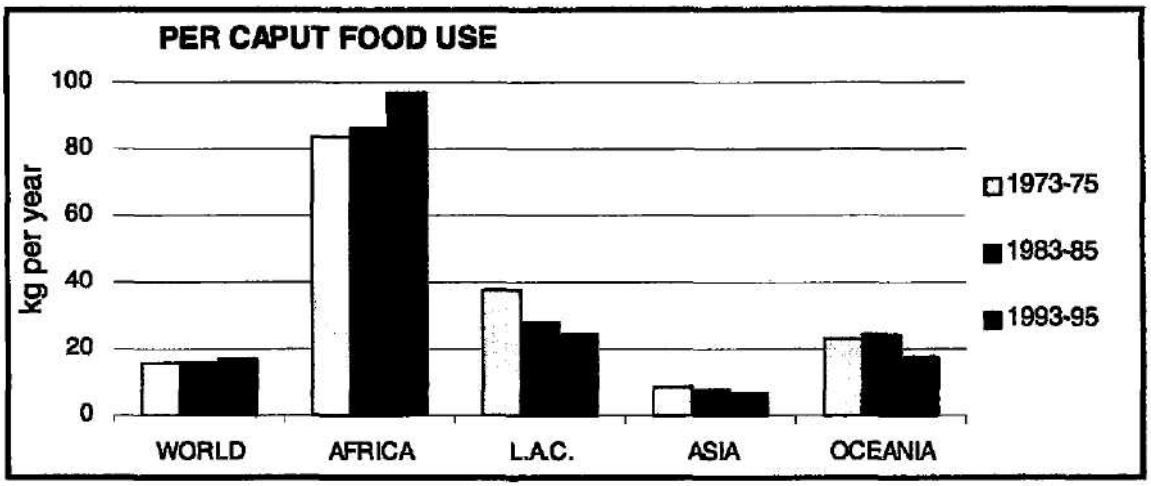


On a per caput basis, cassava consumption averaged 17.2 kilos per year in 1994*, up from 15.9 kilos in 1984*(Table 5) At the world level, it supplied less than 2 percent of the daily calorie intake in 1994* compared with 20 percent for wheat and 21 percent for rice. In Africa the contribution of cassava to calorie intake averaged 10 percent, less than that of wheat or. maize (15 percent each) but more than that of rice (7 percent). However, the calories supplied by cassava exceeded 50 percent of total intake in the Democratic Republic of Congo and were of the order of 35 percent in Angola, the Republic of Congo and Mozambique. Outside of Africa, cassava is a basic food in Paraguay, where it provides 14 percent of total calories, only slightly less than maize (15 percent), the main staple. Per caput cassava consumption has followed an upward trend in Africa in the 1980s and 1990s, but has declined in all the other regions. Several studies have shown a negative correlation between the rate of urbanization and cassava consumption. There is less evidence of a negative relationship between cassava consumption and disposable incomes as demand for fresh cassava has been shown to increase with earnings for population groups in the low and medium income range. Despite a lack of documented evidence on the influence of prices on the demand for cassava food products at the country level, this is likely to be strong given the tight competition with alternative foods, including cereals and other roots and tubers.

Table 5. Per Caput Cassava Food Use [(a)]

	1973-75	1983-85	1993-95	Growth 1973-75 to 1983-85	1983-85 to 1993-95
	(..... kilograms per year.....)			(..... Percent per year....)	
World	15.5	15.9	17.2	0.3	0.8
Developing Countries	21.5	21.2	22.3	-0.1	0.5
Africa	83.5	86.2	97.2	0.3	1.2
Latin America and the Caribbean	37.3	27.6	24.4	-3.0	-1.2
Asia	8.7	8.1	6.8	-0.7	-1.7
Oceania	22.8	24.1	17.3	0.6	-3.3

[(a)] in root equivalent



II. Cassava Feed Utilization

The second most important utilization of cassava worldwide is feed. Roots and leaves are fed mainly to pigs in the cassava producing areas, either fresh or cut and dried. Bitter cassava varieties are the preferred ones for this scope, because of their high starch content. In the last three decades, the transformation of cassava into dried cassava chips and pellets (about two tonnes and a half of roots are needed to produce one tonne of chips and pellets) by producer co-operatives has been promoted in Asia and in Latin America and the Caribbean, for sale to the compound feed or starch factories.

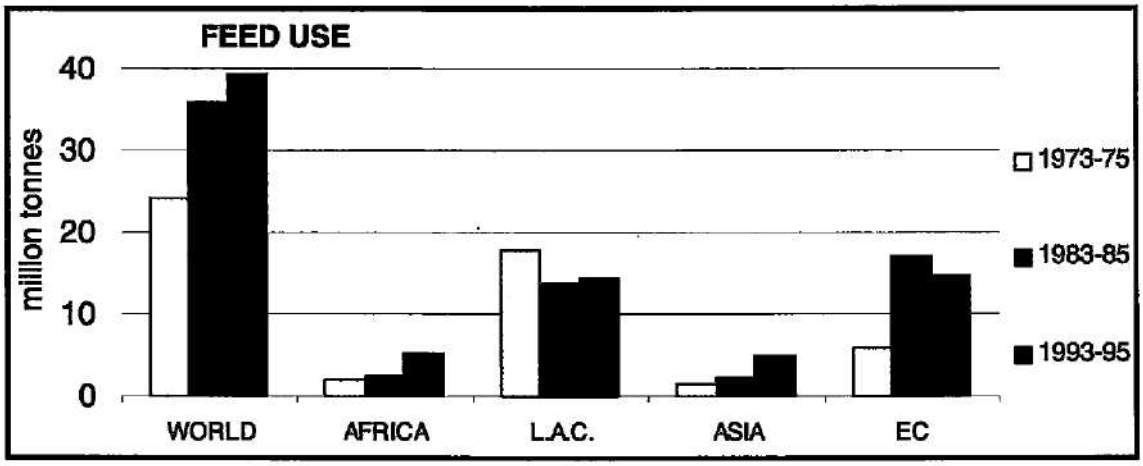
In 1994*, about one fourth of world cassava production was estimated to be used as a feed ingredient for pork, poultry, cattle and fish farming. However, wide differences in utilization exist across regions. In Africa and Asia, only six percent of cassava utilization is accounted for by feed, while in Latin America and the Caribbean the share rises to 47 percent, reflecting high usage in Paraguay and Brazil. In 1994*, about 39 million tonnes of roots globally were estimated to be fed to animals, directly or indirectly through their incorporation into compound feeds, up from 35 millions tonnes in 1984*. The underlying annual growth of less than one percent, was substantially below the 4 percent that had been recorded in the previous ten years. However, the sluggish expansion at the world level in the latest period was very much influenced by a sharp contraction of cassava feed utilization in the EC, which had been the main engine of growth in the 1970s and early 1980s. In the rest of the world, cassava feed usage is estimated to have risen sharply in both Africa and Asia since 1984*, but in absolute terms, the volumes used as feed remained modest. In Latin America and the Caribbean, where some 14 million tonnes of cassava are estimated to be fed, growth has been erratic, with cassava feed consumption falling in the 1970s and early

1980s, when cereals benefited from strong government support, before recovering slightly thereafter. The recent period of growth coincided with a new policy environment, with less government intervention in agricultural production and marketing, but also with a dynamic growth in meat production of the order of 3.3 percent per annum in 1984*-1994*. From that perspective, the increase in cassava utilization as feed has been disappointing, as it has not kept pace with the expansion of the livestock sector. The lack of a more dynamic growth in cassava utilization as feed is often attributed to the relatively high instability of supplies and prices, which makes cassava a less reliable source than grains to the feed industry.

Table 6. Feed Use (a)

	1973-75	1983-85	1993-95	Growth 1973-75 to 1983-85	Growth 1983-85 to 1993-95
	(..... thousand tonnes.....)			(.....Percent per year ...)	
WORLD	24,249	35,812	39,242	4.0	0.9
DEVELOPING	18,299	18,212	24,503	0.0	3.0
Africa	2,012	2,341	5,117	1.5	8.1
Latin America and the Caribbean	17,762	13,549	14,432	-2.7	0.6
Asia	1.521	2,315	4,890	4.3	7.8
DEVELOPED	5,950	17,601	14,470	11.5	-1.9
EC	5,949	17,194	14,556	11.2	-1.7

(a) **in root equivalent**



Cassava is also an important feed ingredient in the EC. Its use in feed rations rose from 1.5 million tonnes (dry weight equivalent) in the early 1970s to 7.0 million tonnes in 1989, before declining to 3.6 million tonnes in 1994*. The strong feed usage in the 1980s was made possible by high domestic cereal prices which allowed cassava pellets in combination with oil meals to compete successfully with grains in that market[4]. Declining cereal prices in the EC following the 1992 reform of the CAP provided the incentives for a greater utilization of grains by the feed industry, hereby depressing demand for cassava. Within the EC, the largest markets for cassava feed products are the Netherlands, Belgium, Germany, Spain and Portugal.

III. Cassava starches and other uses

One of the potential outlets for cassava is the starch market which, according to the International Starch Institute has been growing globally at 4.7 percent per year between 1980 and 1997, from 16 million tonnes to 35 million tonnes for starches from all sources. Starch is used as a raw material for a wide range of food products and of industrial goods, including paper, cardboard, textile, plywood, glue and alcohol. The suitability of the various types of starches[5] to particular applications depends on the physico-chemical properties of the starch granules, including their size, shape and surface and their amylose and amylopectin content. The amylose/amylopectin ratio determines the viscosity, gelatinization, texture, solubility, etc. of the starch. However, the starch characteristics can be enhanced through value-addition techniques, which may be as simple as sterilization, centrifugation and pre-gelatinization, or highly complex chemical transformations. Starches that have been subject to value-additions are called "modified starches", as opposed to the unmodified "native starches".

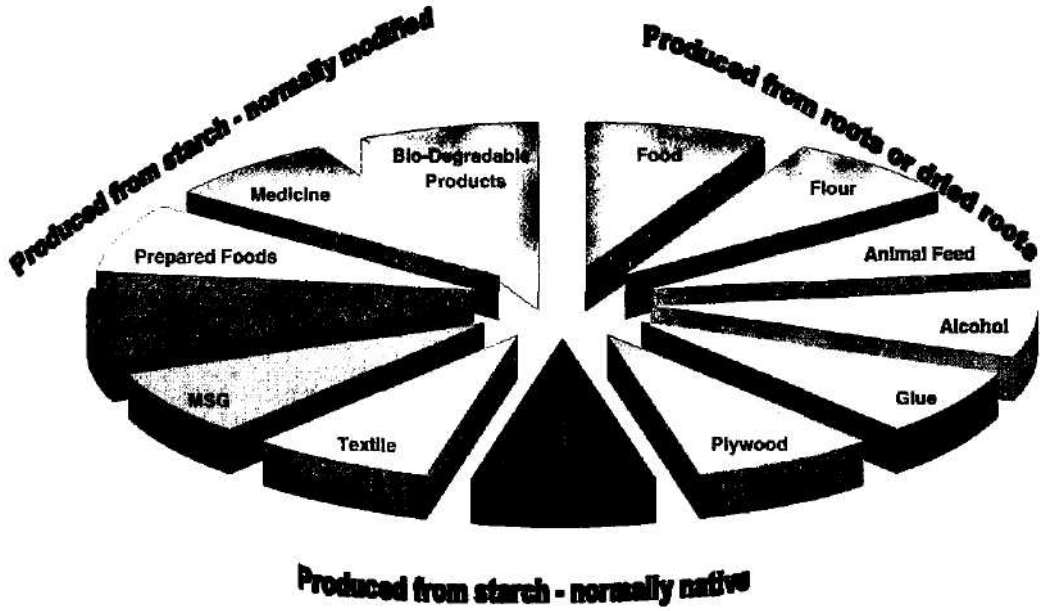
Cassava is the fourth main source for starch production, after maize, wheat or potato. Four to five tonnes of roots are normally required to produce one tonne of cassava starch, but the ratio may be as high as ten to one, depending on the quality of the root. Starch is normally further transformed into value-added products and used for the preparation of glues, alcohol and other industrial uses. In 1994*. cassava industrial utilization was estimated to represent four percent of production at the world level or 6 million tonnes, up from 4.3 million tonnes in root equivalent in 1984*. Most of the cassava starch industries are located in Asia. In this region, processing of cassava into starch is carried out by large

[4] Cassava pellets, used as substitutes for grains in animal feed rations, need to be supplemented with protein meals (e.g. a mixture of 80 percent of cassava pellets and 20 percent soybean meals).

[5] Morton Satin, "Functional Properties of Starches", FAO.

scale factories in Thailand, Vietnam and China. In the first country, industries for the production of cassava modified starch have been set up since the mid-1990s, often under joint-ventures with Japanese firms, for the domestic market but also to meet external demand, mostly from other Asian countries. Thailand, however, constitutes a unique case among the developing countries, as cassava starch production in most of them is limited to native starch. According to Henry[6], although a number of cassava starch factories were set up in Africa in the past decades, such as in Uganda, Tanzania and Madagascar, they are not currently operational. In Latin America and the Caribbean, the cassava starch factories are generally small scale and situated close to the cassava production areas, as the bulkiness of the root justifies their processing locally. Some large-scale, integrated, cassava starch plants have been reported to exist in Venezuela while in Brazil the scale is generally small. One major constraint of the industry is the unavailability of a regular flow of roots for processing. In Brazil, for instance, cassava starch industries must stop working for more than four months a year, because of a lack of raw cassava material. Price fluctuations of the roots and low maize prices also hinder the development of the sector.

Figure 1. Products Derived from Different Forms of Cassava



[6] Guy Henry "Global Cassava End-Uses & Markets: Current Situation And Recommendations For Further Study

III.3 Cassava International Trade

In the 1990s, world trade in cassava products, excluding trade among EC countries, has fluctuated between 5 million tonnes and 7 million tonnes In product weight (between 14 million tonnes and 19 million tonnes in root equivalent), or about 10 percent of global production. The bulk consists of pellets and chips[7] for feed (85 percent) and the balance of starch and flour for food and industrial uses. Trade in fresh cassava is rather limited because of the bulkiness and perishability of the roots. As a result, it is mostly confined to exchanges between bordering countries. Thailand and Indonesia are the major suppliers of cassava to the world market, contributing some 80 and 10 percent of total trade respectively, while the remainder is provided by small exporters in Africa, Asia and Latin America, including Ghana, Madagascar, Nigeria, Tanzania, China, Vietnam and Brazil. Exports from these countries, however, have fluctuated, hindered by the irregularity of supply and by structural problems, in particular the lack of infrastructure for inland transportation and long distances to port facilities. The European Community is the main destination of cassava traded products, in particular chips and pellets for the feed industry. Imports there were facilitated by the low tariff applied on those volumes purchased under the preferential access provisions and the high cereal prices prevailing in member countries. Since the mid-1980s, a few alternatives markets have developed, especially in the Far East and in the former USSR but much of the cassava trade continues to depend heavily on EC imports.

Table 7 **Cassava Trade** [(a)]

	1973-75	1983-85	1993-95	1995	1996	1997	1998
	(.....			in million tonnes			.....)
World Exports	1.7	7.2	7.3	5.2	5.8	6.4	4.9
Thailand	1.4	6.7	5.9	3.9	4.6	5.3	3.9
Indonesia China	0.2	0.3	0.3	0.5	0.4	0.2	0.2
(b) Others	0.0	0.1	0.3	0.4	0.4	0.4	0.3
	0.1	0.1	0.8	0.4	0.4	0.5	0.5
World Imports	1.7	7.0	7.3	5.2	5.8	6.4	4.9
EC China [(b)]	1.5	5.4	5.1	3.3	3.5	3.6	2.9
Japan Korea	0.0	0.4	0.6	0.5	0.3	0.6	0.5
Rep. Others	0.0	0.3	0.4	0.3	0.3	0.3	0.3
	0.0	0.2	0.4	0.2	0.6	0.5	0.5
	0.2	0.1	0.8	0.9	1.1	1.4	0.7

(a) In product weight

(b) Including the Chinese Province of Taiwan

[7] Trade of chips is small, as these tend to disintegrate during handling and transportation.

I. Fresh cassava trade

International trade in fresh cassava roots is mostly confined to transactions between neighbouring countries and is not usually recorded in the official statistics. Its expansion has been hampered by the bulkiness and perishability of the roots, which make them a risky product to market and an inconvenient and expensive food for the urban dweller. However, in recent years the increase in some developed countries of populations originating from Latin America and the Caribbean and from Africa has given rise to an intensification of fresh cassava trade from those regions to the North America and Europe. For instance, Costa Rica has set up the bases for exporting high quality roots, subject to strict quality standard and product specifications, and is currently shipping some 35 000 tonnes a year to the United States and 5 000 tonnes to European countries. Trade in fresh cassava roots, though still very limited, could emerge as a growth market in the future, although this will require improved handling methods to ensure that quality roots reach their destination.

II. Trade In dry cassava chips and pellets.

Demand for chips and pellets for feed is closely linked to livestock production and is very sensitive to the prices of grains, with which cassava competes, and of ollmeals, a complementary ingredient in feed rations. The EC is the principal world market for cassava feed products, as it accounts for about 80 percent of global imports. The other 20 percent of trade find their way to China, Indonesia, Japan, the Republic of Korea, the United States, Australia, New Zealand, Malaysia and the Philippines.

World trade in cassava chips and pellets expanded considerably in the 1970s and the 1980s, from less than 1.5 million tonnes (in dry weight) in 1970 to a record of 10.5 million tonnes in 1989. This remarkable increase was facilitated by the implementation of the CAP in the EC and the bounding in 1968 of the EC import tariff to a maximum 6 per cent ad-valorem duty[8]. The CAP allowed domestic cereal prices in member countries to be well above world levels in most years, thereby stimulating import demand for alternative feeds. Cassava pellets which, when supplemented with protein meals, can substitute for grains in animal rations, could accordingly fetch much higher prices in the EC than In other international markets or in the country of origin itself. The increase in compound feed production in the EC

[8] This replaced the variable Import levy on cassava chips and pellets, established In 1967 at 18 percent of the barley levy.

in the 1970s and the 1980s gave an additional boost to the demand for cassava pellets, which became the major cassava product traded internationally. Since the early 1980s, EC imports of cassava feed products benefiting from the low 6 percent ad-valorem duty have been subject to quantity restrictions. Under the 1994 Uruguay Round Agreement (URA), these were replaced by low tariff quotas, which maintained the same level of preferential access granted in previous years. More specifically, the Co-operation Agreement with Thailand, which allows it to ship an average 5.5 million tonnes to the EC every year, was renewed until 2002. Similarly, The annual quota specifically reserved for Indonesia remained at 825 000 tonnes and, for GATT members other than Thailand and Indonesia, at 145 590 tonnes. Among non-GATT members, China was granted access for 350 000 tonnes and Vietnam for 30 000 tonnes[9], also unchanged from the pre URA levels. Cassava feed imports into the EC above the ceiling are subject to the payment of the barley import duty plus a small fee[10].

EC demand for feed cassava products was met mainly by Asian countries, in particular Thailand. Moreover, the surge in export demand prompted the development of technology in the main supplier countries, for instance for the transformation of the roots into hard pellets easy to handle and transport, or for the construction and equipment of ports and vessels. Thailand was the most dynamic in meeting the requirements for trade expansion. In recent years, however, falling grain prices following the 1992 CAP reform have depressed demand for cassava feed products in the EC and stalled much of the growth of production in Thailand, where the sector was highly dependent on external markets as its main outlet.

iii. *Trade in Starches and Flours*

Trade in cassava flour and starch, which represents some 15 percent of overall cassava trade, expanded markedly in recent years, compensating only in part the contraction in the international market for chips and pellets. The major cassava starch and flour importers are, by order of importance, Japan, the Chinese Province of Taiwan, Hong Kong, China, Indonesia, Malaysia, Singapore, the United States and the Philippines. About 810 000 tonnes of cassava-based starches and flours, in product weight, were exported by Thailand alone in 1994*, up from 445 000 tonnes in 1984*. Trade has continued to rise, surpassing

[9] In addition to a 2 000 tonnes quota of cassava for human consumption.

[10] The so-called fixed levy portion of 3.02 ECU/ton (app. I regulation 1620/93)'

one million tonnes in 1997. Thailand and Indonesia are the major suppliers, but other smaller exporters in Africa, Asia, Latin America and the Caribbean have also gained a foothold in that market. However, exports from these countries have been sporadic as they have faced many constraints, in particular, difficulties in ensuring regular supplies, uneven quality of the final products and price instability on international markets. In addition, the starch market is characterized by a high level of protection, as many users protect their local starch industries.

Tariffs on cassava starch in the main importer countries range from zero in Canada, Indonesia, Malaysia and the United States to 480 percent in the Republic of Korea. They vary between 7.5 and 20 percent in the Chinese Province of Taiwan. In the main markets, starch is imported under preferential access conditions. Japan, for instance, has established an overall 200 000 tonnes tariff quota on native starch from maize, potato and cassava subject to a low 25 percent duty, to be reduced to 15 percent in 2000. Preferential access by the Republic of Korea has been set at a much lower level, as only 2 400 tonnes are allowed to enter paying a low 9 percent duty. The EC has also established a 10 000 tonnes cassava starch quota subject to ECU 170.59 per tonne tariff. Imports beyond the preferential access quota above are often charged prohibitive tariffs.

III.4 International Cassava Prices

Prices for cassava pellets on the international market are determined by the global supply and demand situation for cassava feed products; the prices of the complementary feedstuffs, e.g. ollmeals and that of competing products, e.g. feed grains and grain substitutes. Policies by the major trading countries, especially the EC and Thailand, are also extremely influential. In the past two decades, prices of cassava/soybean meal mixtures in the EC, the major market, were lower than the corresponding barley prices, with the differential in the range of US$ 10-50 per tonne (annex table 7). Since the mid-1970s, the prices of cassava pellets shipped to European ports have fluctuated from a minimum US$ 69 to a maximum US$ 183 per tonne. Since 1995, however, there has been a definite tendency for them to decline.

Cassava pellets to other destinations have been sold at prices much lower than those obtained in the EC. This pattern reflects the export policies instituted by Thailand and Indonesia since the mid-1980s to encourage a diversification of markets. Both introduced a "bonus scheme", under which traders were awarded a given amount of the profitable export

quota to the EC for each tonne sold elsewhere[11]. Such a scheme encouraged traders to offer very cheap prices to non-EC customers as they endeavoured to increase their entitlements for sale to high-price markets in the EC. As a result, the international cassava pellet market was characterized by a two-tier pricing system that contributed to the expansion of cassava exports to non-EC destinations in the 1980s and early 1990s. In 1988, for instance, import unit values for cassava pellets in countries such as Japan, the Republic of Korea, Philippines and Malaysia were in the range of US$ 60-80 per tonne, i.e. about one third lower than those fetched in the Community. These stimulated sizeable cassava Imports for feed or alcohol production by the Republic of Korea, Japan, the former USSR and eastern European countries. Since the withdrawal of the bonus system and the CAP reform in the 1990s, the price differential between EC and non-EC markets has narrowed substantially.

Export prices of cassava starch and flour (Super High Grade quality, F.O.B. Bangkok) from Thailand, the largest producer and exporter, have fluctuated between US$ 195 per tonne in 1993 to US$ 313 per tonne in 1995 and have averaged US$ 269 per tonne in 1994*. More recently, they have been on a downward trend and have fallen to US$ 163 per tonne in July-August 1999, their lowest level since 1988. Relative to its substitutes, cassava starch appear to be highly competitive (Table 8), especially taking into consideration that producers and processors of starches in the EC and in North America benefit from a series of direct and indirect government support.

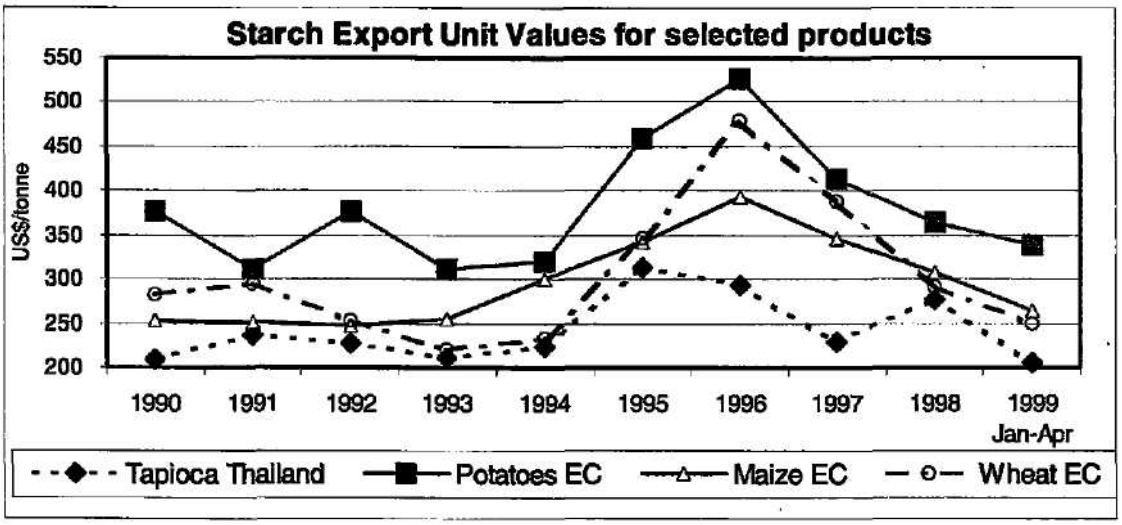
Table 8 : Comparison of Export Unit Values for Selected Starch Products (In US$)

Year	Cassava Flour/starch Super High Grade f.o.b. Bangkok	Cassava Starch/ Flour Thailand	Potato Starch EC	Maize Starch			Wheat Starch		
				EC	USA	Canada	EC	USA	Canada
	f.o.b. price	(.....Export Unit Values.....)							
1990	226	209	376	253	559	273	283	695	310
1991	240	237	311	252	599	284	296	719	238
1992	232	227	377	246	586	261	252	535	235
1993	195	212	312	256	615	267	220	443	263
1994	256	223	320	300	594	288	233	565	250
1995	358	313	459	342	463	275	346	441	328
1996	277	294	526	393	468	303	480	526	346
1997	244	228	413	345	449	303	388	412	343
1998	276	n.a.	365	308	499	302	292	374	334
1999 [(a)]	205	n.a.	339	263	n.a.	n.a.	250	n.a.	n.a.

[(a)] January to April n.a. = not available

Source: Thailand Tapioca Trade Association, Eurostat and FAOSTAT.

[11] For instance, in 1994 for each tonne sold to non-EC countries, Thai exporters could sell 3.8 tonnes to the high-priced EC market



III.5 Cassava In the Main Producing Regions

I. Cassava In Africa

Over 50 percent of the current global cassava production are grown in Africa. Although the crop is cultivated in 39 countries, stretching through a wide belt from Madagascar in the Southeast to Senegal and to Cape Verde in the Northwest, nearly 70 percent of the region's output is harvested in Nigeria, the Congo Democratic Republic and Tanzania[12]. Cassava in the main producing countries is a basic staple in the diet, but also an important source of cash incomes, as farmers sell a sizeable share of their output[13]. In other parts of the region it is cultivated for security purposes as a food reserve in case of failure of the other basic crops and is often harvested as needed, since farmers take advantage of the root aptitude to keep stored under ground for up to 24 months[14].

Although large-scale production systems have been set up in response to export opportunities in countries such as Ghana, cassava in Africa is traditionally cultivated by small farmers who use to plant it last in the rotation with other crops, either before fallow or

[12] Nonetheless, the contribution of the crop to the national agricultural product can be very high also in other countries. For instance, in Ghana, cassava is the major contributor to agricultural production value, with 22 percent, compared with 5 percent for maize and 14 percent for cocoa.

[13] According to research carried out at the IITA, cassava "is a commercial crop in sub-Saharan Africa,... and both rich and poor farmers often sell a higher proportion of cassava and /or derive more cash income from cassava than from any other crop or income-earning activity". Nweke, F (1988,1995).

[14] Cassava can be harvested 8 to 24 months after planting.

increasingly in replacement of the fallow in densely populated areas. This practice has meant that, although cassava could benefit from residual fertilizer applications, yields remain far below potential. Cassava has proved to be an emergency food reserve crop, especially during civil unrest or droughts. This property was highly valued during the 1982-83 drought and contributed to the acceleration of production growth in the region from 2.4 percent per annum in 1974*-1984* to 4.2 percent per annum during the following ten years.

Most of that increase was based on an expansion in the area under cassava, which rose at an annual rate of 3.1 percent between 1984* and 1994*, much faster than the 0.7 percent growth recorded in the previous decade. The acceleration in the rate of expansion in cassava cultivation since the mid-1980s coincided with a reduction of government support to cereal and cash crop production and marketing and with a cut in input subsidies under structural adjustment programmes, which may have encouraged a shift towards the less input-demanding cassava cultivation. In some cases, this substitution was also prompted by government policies aimed at reducing the dependence on cereal imports. In Nigeria, for instance, the imposition of the ban on wheat and rice imports in 1987 set the bases for a large expansion in cassava cultivation, which went from 1.1 million hectares in 1984* to 2.9 million hectares in 1994*, growing at an annual rate of 10.2 percent. Over the same period, notable area increases were recorded in Angola, Benin, the Congo Democratic Republic, Côte d'Ivoire and Ghana. By contrast, production fell in Mozambique, Tanzania and Uganda.

Cassava yields in the region vary from a high 18.5 tonnes per hectare in Cameroon to a low 5.3 tonnes per hectare in Angola. At the regional level, they averaged 8.2 tonnes per hectare in 1994*, little changed from the 7.3 tonnes per hectare in 1984*. This lack of progress reflected a number of constraints, including the low fertility of the lands where cassava is normally grown, the low application of inputs and the relatively slow dissemination of improved cassava varieties adapted to local conditions and tastes. Indeed, by 1995, a review by the International Institute for Tropical Agriculture (IITA)[7] concluded that, up until the early 1990s, "the potential of the existing improved varieties had not been fully exploited; the new varieties were still largely confined to Nigeria". This country certainly benefited from the presence on its territory of the IITA, which played an essential role in the promotion and dissemination of improved cassava varieties. In the rest of the region, wars, civil strife and the resulting economic dislocation prevented major yield improvements from taking place. Adverse climatic conditions, i.e. prolonged droughts in many parts of Africa, and the recurrence of infestations by the cassava mealybug (CMB), green spider mite (GSM) and outbreaks of African cassava mosaic virus (CMV), have also impaired productivity in many

areas. Indeed, it has been estimated that pests, including weeds, reduce yields by almost half, while the African CMVs alone is estimated to lower them by between 28 percent to 40 percent. However, the danger posed by the CMB, which threatened to wipe out cassava in the 1970s, has been considerably reduced owing to the combined efforts of the IITA and the Centro Internacional de Agricultura Tropical (CIAT) through technology transfer. Other networks such as the Southern Africa Research Network (SARRNET), the Eastern Africa Research Network (EARRNET) and associations like the Association for Strengthening Agriculture in Eastern and Central Africa (ASARECA) and the Southern Africa Centre for Co-operation and Agricultural Development (SACCAR) are also contributing to the enhancement of cassava productivity in the region.

In Africa, cassava is a basic food staple in a number of countries including Angola, the Congo Democratic Republic, the Republic of Congo, Ghana and Tanzania, where per caput consumption surpasses 200 kilos per year. It is also an important foodstuff in Benin, the Central African Republic, the Côte d'Ivoire, Liberia, Mozambique, Nigeria and Togo. Cassava is processed mainly for human consumption, with women responsible for most of the related activities. Although feed accounts for only 6 percent of total utilization, this share has been rising in recent years, in parallel with livestock production. Cassava leaves are also eaten as a vegetable in central Africa. The most popular processed products are commonly known as "gari", "lafun", "foufou", "makopa", "kivunde or kondowole" and "chlckwangue". Gari, a dry granular meal made from moist and fermented cassava, is the most common form of cassava consumption in West Africa, especially in Nigeria, Ghana, Cameroon and Côte d'Ivoire. Other popular processed cassava products include "lafun" a sun-dried cassava product popular in Nigeria and "foufou" sticky or heavy soup made from fermented cassava. In Tanza nla, peeled roots are usually sun-dried for one or two weeks and subsequently processed into storable products called "makopa", "kivunde" or "kondowole". Other methods use fermentation to enhance mould growth in products such as "nyange" and "bada". In other countries, cassava is commonly consumed in the form of flour, called "attiéké" and "chickwangue". Dried cassava can also be stored and subsequently milled or pounded into flour for making stiff porridge and consumed with different relishes such as meat, fish, beans, green leafy vegetables and cassava leaves. The use of cassava flour in bread has become widespread in Nigeria and the Côte d'Ivoire. In this country, the practice of mixing cassava flour to wheat flour in bread initiated in 1982. On average, cassava per caput consumption in the region has been rising from 86 kg per year in 1984* to 97 kg per year in 1994*. However, there have been contrasting patterns with notable increases recorded by Angola, Benin,

Ghana and Nigeria, which contrasted with substantial falls in Cameroon, Mozambique, Tanzania and Uganda.

Government support to the sector in Africa has been mainly confined to research into the eradication of the main pests and diseases, the development of high yielding, disease-resistant varieties and, in a number of countries, to their dissemination among farmers. For example, in Ghana, the recently launched Roots and Tubers Project aims at raising output through the introduction of new cassava varieties better adapted to the processing of the roots. In Tanzania, the Government, under the National Agriculture Master Plan, is focussing on cassava and sweet potatoes to cover food deficits. Similarly, in Uganda the Government is encouraging the substitution of new high-yielding and pest-resistant cassava varieties for banana plantations in the Southeast regions and for sorghum/millet cultivation In the South. In most of the region, cassava has been also indirectly influenced by the changes in Government policy strategies towards reduced intervention in Agriculture under structural adjustment programmes. With the dismantling of public marketing agencies and the removal or reduction of price subsidies granted to cereal producers, cassava has recovered some of its comparative advantage. In the coming years, the intensification of natural resource constraints in the region, especially as regards water availability, may play a key role in forcing the Government and the private sector to pay increased attention to the development of the cassava sector.

II. Cassava In Latin America and the Caribbean

Although cassava is native from Latin America, the region currently accounts for less than 20 percent of global output. Production trends in the region follow closely developments in Brazil as this country contributes over three-quarters of the regional aggregate. Paraguay, Colombia, Ecuador, Panama and Peru follow well behind as the most Important producers in the region. Cassava in Latin America and the Caribbean has adapted to very different ecological systems and developed a large genetic diversity, only part of which have been introduced into Africa and Asia. Although pests and diseases act as a constraint to production, their impact has been less severe than in Africa, because of the development of resistant or tolerant strains and bio-ecological control. The traditional cultivation practices, based on inter-cropping or crop rotation, also helped check the incidence of pests and diseases. Cassava is mainly produced by small farmers, with little use of chemical inputs, and plays an important role for food security and for income generation.

Nonetheless, the growth of the sector in the region has been sluggish in the last decade: between 1984* and 1994*, production rose from 28.6 million tonnes to 30.8 millions, or less than one percent per annum, as demand for cassava food products stagnated. Although new markets for cassava as feed and starch have developed, they have not been sufficient to sustain a more dynamic growth of the sector but have contributed to a reversal of the negative production trend which had dominated the region from the mid-1970s to the mid-1980s.

Cassava cultivation in Latin America and the Caribbean remained stable between 1984* and 1994* around 2.6 million hectares. It even fell slightly in Brazil, reflecting production constraints including drought in 1990-1993 but also limited market prospects as the crop in the country competes directly with local cereals in the diet, in feeds and for the production of starch[15]. About 70 percent of cassava output in Brazil are produced in the poorest regions, in the north and north-east. However, its cultivation is gaining importance in the southern states better placed to take advantage of a growing demand for flour and starch and where more intensive methods of production are applied. In the other major producing countries in Latin America, the area under cassava expanded, albeit modestly. In most cases, the increase coincided with a shift towards semi-arid regions and marginal land cultivation. In Colombia, almost 50 percent of production are currently harvested in the traditional growing area on the Atlantic north coast[16], where small-scale farmers derive nearly 40 percent of their total incomes from cassava production. The tendency for moving cassava out of the more fertile lands in the main producing countries explains to a large extent the lack of major productivity gains in the region between 1984* and 1994*. The modest increase in yields recorded over that period was mainly driven by improvements in cultivation practices associated with the introduction of new varieties. However, widespread dissemination of those varieties among producers has not yet been achieved. In Brazil, for instance, it was reported in 1995 that many farmers continued to rely on traditional varieties.

Post harvest losses are estimated to account for 10 percent of production in the region, not much above the 8 percent estimated for cereals. Only 35 to 40 percent of cassava supply are used as food in the region, as per caput consumption has tended to stagnate or even decline. Although cassava is predominantly consumed fresh, a large number of products derived from cassava starch or flour have been developed in countries

[15] Despite its potential use as Input for alcohol production, cassava has never seriously competed with sugarcane for methanol production.

[16] The Government's four-year Plan for the improvement and strengthening of the cassava agro-Industry on the Atlantic Coast has the objective of developing processing Industries for chips, pellets and flour to meet the growing demand.

such as Brazil, Colombia, Ecuador, Panama, Guyana, Jamaica and Venezuela. In Colombia, a fermented starch called "Sour" is used to prepare snacks and traditional gluten-free cheese breads, called "pan de yuca" and "pan de bono". In the countries of the Caribbean basin, moist cassava pulp is used to prepare a thick cake called "bammy". Unleavened bread known as "casabe", is also a speciality in that area. In Brazil, the traditional cassava flour products are the "farinha de mandioca", popular in northern Brazil and neighbouring areas, and a pre-cooked flour called "farinha da mesa". A number of new cassava flours and starches are being used by the food industry and fast-food outlets. For instance, naturally fermented cassava starch, known as "polvilho azedo", is utilised in bread making. In the southern, central and western regions, a kind of bread made of sweet and sour cassava starches, cheese and eggs, "pão de queijo", is consumed virtually by every family. With 48 percent of total utilization, feed is estimated to be the most important purpose for cassava in the region. This pattern is very much influenced by the large share of cassava fed to animals in Brazil and Paraguay. In Colombia, cassava feed use continues to be modest relative to the volumes destinated to food consumption, even though small-scale factories for the chopping and drying of the roots have been promoted in the producing areas to supply chips to the feed industry. Industrial use of cassava in Latin America and the Caribbean is estimated to absorb about 6 percent of availability in 1994*. The development of new cassava products in the region has been supported by the Integrated Cassava Research and Development Project (ICRDPs), initiated in the mid-1980s by the International Centre for Tropical Agriculture (CIAT) and counterpart institutions. The project also contributed to promote cassava for non-food utilization, including feed and industrial applications. The extraction of starch and flour out of cassava is an activity in expansion in the region, which has also benefited from the ICRDP.

Governments in all the main producing countries in the region have established some cassava programmes and, more recently, have adhered to the ICRDPs which were designed to link small-scale cassava farmers in several countries to new or improved growth markets. Unlike in Africa, government support has also embraced down-stream activities, including processing into dry cassava chips, flours and starches. For instance, in Ecuador, new cassava-based products were developed within the Integrated Cassava Programme. In Peru, government provided assistance to the establishment of pilot plants for flour production and the development of machines prototype for cassava processing. In Colombia, the Government has assisted in the setting up of pilot plants in the Atlantic Coast, for the production of cassava flour and starches and of dry chips for feed. For a few years since 1989, cassava growers in the country also benefited from minimum guaranteed producer

prices and preferential credit. In Brazil, during the 1960s and early 1970s the utilization of cassava flour as a partial substitute for wheat in bread making was supported by policies that required the incorporation of a small percentage of cassava flour in bakery products. However, in the mid 1970s, heavy wheat flour subsidies were introduced and traditional starchy staples such as cassava had to compete with wheat based starches at a substantial disadvantage. Such subsidies were greatly diminished in the following decade, which restored cassava competitive edge. Until the mid-1990s, the Government guaranteed minimum support prices to cassava producers, which resulted in intervention purchases and cassava stock building by the Government when prices were low. Since the launching of the Real Plan in 1994, Government intervention in marketing has been reduced, and assistance to producers is now mostly limited to the provision of subsidized loans for crop planting. Minimum producer prices are still announced but they only are used for estimating the value of the loan granted to the producers.

III. Cassava In Asia

Asia experienced a sharp expansion of cassava production between 1974* and 1984*, from 30.3 million tonnes to 47.4 million tonnes, or 4.6 percent per annum, sustained almost equally by increases in yield and area. Growth in the region was underpinned by strong gains in Indonesia, the Philippines and especially in Thailand where the sector was stimulated by a very dynamic demand for export. As external markets have faltered, production growth since the early 1980s has been much slower, at 0.5 percent per annum, bringing cassava output in the region to 50 million tonnes in 1994*. Thailand and Indonesia rank first and second among Asian producers, accounting together for 70 percent of the region output, followed by India, China, Vietnam and the Philippines (see annex table 1).

As in the other main producing regions, cassava in Asia plays a significant role for food security and income generation in some of the poorest areas, as it is produced by small farmers in marginal lands, most of the time in association with other crops. Thailand stands as an exception since cassava there is cultivated as a mono-crop and inter-cropping is not usually practised. This feature reflects the history of the development of the cassava sector in the country, as much of its expansion in the 1970s and 1980s was export-led by a growing demand for dried cassava by the EC. Thus, the opening of external markets, was the underlying force to the sector's expansion in Thailand in the 1970s and 1980s, much of which was based on an increase of the area (10.4 percent) and, to a much smaller extent, of yields (1.3 percent). Although output reached a peak of 24 million tonnes in 1989, it has been

on a declining trend since then, reflecting a fall in both plantings and yields. The productivity loss has been imputed to the continuous use of a single cassava variety, i.e. Rayong 1, and to the scarcity of fertilizer applications rather than to diseases or pests, as few of them infest cassava plants in the region. As for the contraction In cassava plantings, it was partly induced by Government policy since 1993, that aimed at reducing plantings by some 20 percent as part of a Thai-EC agreement, but also by to rising costs and falling sector profitability as the prices fetched in the Community started to fall. Cassava in Indonesia has traditionally been planted in association with other crops by small farmers, mainly for their own consumption. Cassava cultivation used to be concentrated in Java, but as pressure on land and other resources intensified, it has been spreading to the other islands, especially Lampung.

Between 1984* and 1994*. production increased at an annual rate of 2.3 percent, driven mostly by yield improvement (1.9 percent per year), as there was little variation in the area planted. The boost in yields reflected the adoption of Improved cassava varieties, especially in areas supplying starch factories. In recent years, however, the country has been facing repeated droughts, which has affected negatively both area and yields. India is the third largest Asian producer. Cassava production is mainly concentrated in Kerala, Tamil Nadu and Andra Pradesh. Cassava and other root crops are locally the most important food crops after cereals. Between 1984* and 1994*, the area under cassava cultivation in the country contracted steadily at an annual rate of 2.4 percent. However, this decline has been more than compensated by increases in productivity (2.8 percent) and output reached 5.8 million tonnes in 1994*. Yields are among the highest in the world, averaging 24 tonnes/hectare in 1996. Cassava is grown in China as a food security crop, especially in the southern Guangdong, Guangxi and Hainan provinces. In the last two decades, productivity was enhanced through the adoption of improved cultivars and farming practices, in response to demand from small and large-scale industries. Between 1974* and 1984*, production expanded at an annual growth rate of 4.9 percent but it contracted in the following years as farmers shifted to more profitable crops. Over the period, cassava moved from being a food security to a cash crop, as it was increasingly grown to supply raw material for the starch industries. In Vietnam, cassava is a secondary crop[17]. In the North, however, the crop is an important source of food and feed at the household level; in the South it is mainly a source of

[17] Under the national Root and Tuber crop program established in 1990, the Government has adopted a development strategy for roots and tuber crops in general, and for cassava in particular, aimed at turning cassava into a crop which generates income for producers and processors (Cassava Production, Processing and Marketing in Vietnam - Proceedings of a Workshop held in Hanoi, October 1992. - Ministry of Agriculture and Food Industry and CIAT).

cash income and is used as a raw material for processing. Cassava is often grown on hilly land, some of which is severely eroded. From 1984* to 1994*, cassava area declined at an annual rate of 2.0 percent, driving production down from 3.0 million tonnes to 2.3 million tonnes. The average yield in the country is still relatively low due to infertile and highly eroded soils, lack of financial resources and poor management practices. However, in recent years, new cassava growing areas (former waste lands) in the south have been brought under intensive cassava cultivation using improved varieties with high starch content.

In Asia, some 40 percent of the cassava produced are for direct human consumption, while another 8 percent is disposed as waste or lost. Although the demand for cassava sago and industrial starch has strengthened in recent years, industrial cassava utilization accounts for only 6 percent of the regional output Per caput food consumption levels, are relatively low and have shown a tendency to fall between 1984* and 1994* from 8 kg to 7 kg per year, reflecting changes in the economic environment and food preferences. Consumption varies considerably between social strata: Cassava is a cheap source of calories, mainly for the rural poor, and a substitute for rice when this is in short supply.

The major consumers of cassava in Indonesia and India are the rural poor. In India, baked roots are a principal form of cassava consumption. Roots are also converted into small chips, flour and "sago", a type of wet starch that is roasted. In Indonesia, cassava roots are eaten boiled or steamed and processed into dried chips, known as "gaplek", and starch. Gaplek is used for human consumption in a large variety of traditional dishes and, in times of rice scarcity, it substitutes for rice in rural diets.

In Malaysia and Thailand, cassava roots are mostly used in the manufacture of starches and in the local feed industry. However, consumption of cassava-based noodles, cakes and pastry has expanded in recent years. China and Vietnam also deserve particular attention, because of their very dynamic markets. High domestic demand for starch in the two countries has attracted strong interest in cassava processing, which in turn has boosted the demand for roots at the farm level.

In the Philippines, cassava or "kamoteng kahoy" is the mainstay of some regional muslin cuisine. However, it is increasingly processed into dried chips for export to Europe or for local use as a source of energy in aqua-culture and livestock feed.

The production of starches from fresh or chipped cassava roots is gaining importance in the reglon, particularly in China, India, Indonesia, Thailand and Vietnam, for both industrial uses and human consumption. In China, cassava starches are processed at the household level and are primarily used to make noodles and monosodium glutamate (MSG), a popular flavour used in Asian cooking. Other industrial uses include sweeteners, such as glucose syrup (GS), medical glucose, maltose and high fructose syrup (HFS). Similarly in India, cassava starch is mainly used for household consumption and to prepare glucose and dextrin. In the northern regions, it is also used in the textiles industries. In Indonesia, about 10 percent of the cassava production are processed to obtain starch, two thirds of which is used to make krupuk, a crunchy native food. Another 15 percent of cassava starch are destined for other foods, 10 percent for textiles, and 3 percent for glucose. In Thailand, extraction of starch is carried out at an industrial level, and starch millers compete with traders in the purchase of cassava chips and pellets from farmers. In the country, only one third of cassava starch production is consumed domestically as the rest is exported. It is mainly processed into food products (largely noodles); MSG and lysine (19 percent); GS (15 percent); paper industries (9 percent); textiles (3 percent); plywood (1 percent) and others (13 percent). The food and glucose markets have been the fastest growth markets, since they were small or non-existent in the early 1980s. In Vietnam, households form the largest group of direct users of cassava starch, for the preparation of cakes, fried meats and fish, soups and other traditional Vietnamese dishes. The food processing industry, currently the second largest user in the country, consumes about 25 000 tonnes of high quality dry cassava starch per year in bread, rice chips and cakes production, mixed with starches from other origins, including soybean, green beans, rice and wheat flour.

IV CASSAVA MEDIUM-TERM OUTLOOK

IV.1 Supply

World cassava production is projected to maintain a two percent annual growth between 1994* and 2005, rising to 208 million tonnes in root equivalent (Annex Table 1). The rate of expansion is anticipated to be of the order of 3 percent in Africa, while it is likely to be more modest in Latin America and the Caribbean and in Asia, at 1 percent. Compared with the previous decade, growth in yields is anticipated to rebound, reflecting the wider uses of improved varieties by farmers (Annex Table 2).

In **Africa,** output is expected to reach 114 million tonnes in 2005, up from 83 million tonnes in 1994*, with the bulk of the increase accruing in the major producing countries, in particular Ghana and Nigeria. The expansion should rely almost equally on increased plantings and on yield improvements. In **Latin America and the Caribbean,** total output is projected to expand at an annual growth rate of 1.3 percent to 36 million tonnes in 2005, with higher rates expected in Argentina, Brazil, Colombia and Paraguay. Like in Africa, the sector should benefit both from an increase in area and yields. Production in **Asia** is projected to rise by 1.3 per year to 58 million tonnes, supported mainly by productivity gains following the adoption of high-yielding and disease resistant varieties, integrated pest management and soil and conservation techniques. In Thailand, the adoption of improved cassava strains is expected to boost productivity in the medium term. Similarly, in Vietnam, the shift from traditional to high-yielding varieties should help reverse the contraction in yields observed in the past decade.

IV.2 Utilization

Cassava utilization in the year 2005 is anticipated to follow closely production patterns. Indeed, international trade in cassava products is projected to remain small relative to output and to engage only few countries. In addition, stocks in dry cassava should continue to be rather small given practice of keeping the root stored in the ground. Total utilization is projected to grow at 2.2 percent annually, from 162 million tonnes to 208 million tonnes (see Annex Table 3), with food consumption representing about 59 percent of the total. The shares of feed and other uses, including waste, are projected at 22 percent and 19 percent of total availability respectively, i.e. slightly less than in the previous decades.

I. Food

Cassava food consumption is projected to rise from 96 million tonnes En the base period to 122 million tonnes by the year 2005 (Annex Table 3), sustained mainly by growth in the developing countries, especially Africa. On a per caput basis, cassava consumption is projected to rise from 17.2 kg in 1994* to 19.0 kg in 2005. Africa's expansion in aggregate consumption should respond mainly to the rise in population, since growth in per caput levels is anticipated to be modest. Nonetheless, per caput food availability is anticipated to rise by 4 kg over the period, underpinned by a positive income effect that more than offsets the negative influence of urbanization. In **Latin America and the Caribbean,** cassava food utilization is expected to follow closely the change in population as per caput consumption is anticipated to change little. In **Asia,** food utilization is projected to rise by 1 percent a year. However, on a per caput basis, consumption Is projected stabilize around 6.6 kg, which would imply a reversal from the falling trend recorded in the previous decade (Annex, Table 6). This new tendency should be associated with the increased availability on the market of processed cassava products, such as dehydrated chips, flakes, flours, meals, snack foods, cake mixes, bread cookies, ice creams or beer.

II. Feed

Overall, growth in cassava utilization as feed is expected to rebound to an annual rate of 1.6 percent, to 46 miliion tonnes, up from 0.9 percent in the preceding period (Annex Table 4). Among the developed countries, EC's feed utilization is likely to stabilize around the levels recorded in 1994*, which would be substantially below 1984*. Cassava usage by the other developed countries is anticipated to remain very limited. In the developing countries, feed demand is projected to grow at a slower rate than in the 1980's. Feed utilization is projected to be concentrated in Nigeria, Brazil and China. In the case of China, major efforts are currently being made to support the feed Industry and to improve the utilization of local feed resources, including cassava and potatoes. In the other producing countries, a fast expansion of the domestic livestock sector is anticipated to boost the demand for cassava as feed, although the quantities absorbed by the animal sector are likely to remain small. Although cassava has a large and untapped potential as an energy feedstuff, cassava feed demand in the future will depend mostly on the relationship between the prices of cassava combined with protein meals and feed grains.

III. ***Post-harvest losses and other uses***

Cassava utilization other than for food or feed includes post-harvest losses, which in the base period accounted globally for 19 percent of production, and industrial uses. The share of cassava waste was much smaller for Latin America and the Caribbean and for Asia, at 10 percent and 8 percent respectively, while it was of the order of 29 percent in Africa. Success in controlling diseases, together with improved marketing practices in the latter region, should help reduce the share of waste in Africa to 16 percent. In Latin America and the Caribbean and in Asia, little change is anticipated as the percentage of post-harvest losses in production for cassava is already low and only slightly above that for cereals. Thus, waste at the world level is projected at 26 million tonnes in 2005, or 13 percent of production.

Cassava utilization for other uses, including utilization in the manufacturing of paper, cardboard, glues, textile, resins, composite woods, Pharmaceuticals, alcohol, dextrin, etc., is estimated to grow from 5.9 million tonnes in 1994* to 12.9 million tonnes in 2005 in root equivalent, or 13 percent per year. Such an expansion would be driven by a dynamic growth in demand, especially in Asia, which is expected to account for more than 60 percent of total cassava industrial utilization. A more modest expansion is anticipated in Latin America and the Caribbean, supported by ongoing Government programmes to promote cassava market diversification. Industrial utilization in Africa is expected to record a strong expansion, albeit from very low levels. Thus, although it may arise as a major growth market in the medium term, the industrial use of cassava is likely to remain of secondary importance, after feed use. Industrial demand for cassava in the region may nonetheless play an important role in enhancing producer and processor cash earnings and in generating foreign exchange savings as cassava starch substitutes for alternative imported products.

IV.3 International Trade

World net trade[18] in cassava products is projected to increase by 1.6 percent between 1994* and 2005 to 5.7 million tonnes, in dry weight equivalent, as the reduction in imports tariff following the 1994 URA Agreement is expected to enhance cassava trade only modestly. Although chips and pellets for feed are likely to remain the leading cassava traded

[16] International trade In cassava products to the year 2005 was derived as the difference between projected production and utilization. It therefore provides an estimate of net Imports in root equivalent. The net trade approach Implies that the size of the transactions is underestimated..

product, international flows in cassava flour, starch and other high value-added cassava products are likely to intensify the most.

On the demand side, net imports by the developed countries are anticipated to record only a marginal increase, from 3.9 million tonnes to 4.0 million tonnes. The EC should remain the most important cassava market. However, shipments there are likely to stay well below the quantities allowed for import under preferential conditions as the tendency for domestic grain prices to fall is envisaged to persist following the launching of the Agenda 2000 reform. Among the other developed countries, Japan should remain an important market for cassava products, especially for flours and starch. Imports by the developing countries are projected to provide the main momentum to trade by 2005. India, Malaysia, Pakistan, Colombia, Cuba, Paraguay, Peru and Venezuela are all anticipated to step up their purchases of cassava chips and flours, which they are likely to source from neighbouring countries.

Thailand is anticipated to remain the leading exporter of cassava products, followed well behind by Indonesia and by other small suppliers, including Ghana, Nigeria, Brazil, Colombia and Venezuela.

Trade projections have taken into consideration the likely decline of intervention prices for grains in the EC. In the 1998/99 season, intervention prices were set at 119.19 ECU/tonne, or US$ 132/tonnes[19], compared with a domestic market prices of US$ 145 for barley. Under the Agenda 2000 CAP reform, the EC grain intervention prices are scheduled to be cut by 15 percent by 2001/02 to some Euro 100 per tonne[20]. Assuming market grain prices fall close to that level by 2005, or US$ 1 1 1 per tonne using the 1998/99 average exchange rate, cassava pellets prices would need to fall from the current US$ 102 to US$ 75 /tonne[21] in order to remain competitive. Given reported marketing margins in Thailand, prices at the farm would fall to some US$ 37 per tonne for dry cassava pellets, or less than US$ 15

19 At the exchange rate prevailing in December 1997.

20 In two equal installments of 7.5 percent In 2000/01 and 2001/02.

21 To reach this level, it was assumed that one tonne made of 80 percent cassava pellets and 20 percent soybean meal is used as a substitute for one tonne of barley. Soybean meal prices were also assumed to remain constant at the 1996-98 average.

per tonne in root equivalent (or Baht 600 per tonne[22], at an exchange rate of Baht 40 per US$ prevailing in September 1999, (see explanatory note).

Production costs of cassava roots in Thailand have been reported to vary from Baht 550-650 per tonne for old strains (US$ 14 to 16 per tonne[23]) and from Baht 350-450 per tonne (US$ 9 to 11 per tonne) for new strains. Thus, only the lowest-cost producers will find it profitable to produce cassava for export to the EU. The prospects for CAP reform could therefore seriously impair the future competitiveness of cassava as a feed ingredient in the EC and force cassava producers to look for alternative markets. In this connection, the development of niche markets for special cassava products is expected to instil additional dynamism to the sector, although this will depend to a large extent on a removal of the restrictions that hinder international trade, especially for starch products, in the form of high tariff and non-tariff barriers.

[22] Average root prices in Thailand in 1998 and 1999 were respectively 1,785 and 1,027 baht per tonne,equivalent to US 46.5 and US$ 26.2 per tonne substantially above the prospected prices under the CAPreform scenario.

[23] using the exchange rate of baht 40 per US $ prevailing during most of 1999.