

Marketing Opportunities for cassava based products: An Assessment of the Industrial Potential in Kenya

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PREFACE

This study was carried out by the Department of Food Science Technology and Nutrition of the University of Nairobi, in collaboration with Foodnet which is a regional network promoting marketing oriented research in order to identify opportunities for value added processing of agricultural products.

Funding was provided by USAID through ASARECA, a sub-regional research organisation coordinating the Foodnet network

Prof. Edward E. Karuri, Prof. Mbugua and Dr. Joseph Karugia of the University of Nairobi and Kelly Wanda and John Jagwe of IITA-Foodnet wrote the report.

ABBREVIATIONS

ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
IITA	International Institute of Tropical Agriculture
KAM	Association of Manufacturers of Kenya
CPC	Corn Products Corporation (Kenya)
SBA	Starch-Based Adhesive
USAID	United States Aid for International Development

ACKNOWLEDGEMENTS

Much effort has gone into the preparation of this report. We wish to appreciate first and foremost the co-operation that we received from the personnel in the industries visited in the various parts of the country. Their willingness to provide us with relevant information without fear despite our calling on them at very short notice was very encouraging. Special thanks go to those who embraced our effort and were willing to participate in future industrial trials.

We would like also to thank all the staff of the Department who tirelessly devoted their time in supporting this survey.

Lastly, it ought to be pointed here that without the financial support from USAID through the Foodnet ASARECA network this report would not have been written and published.

SUMMARY

Since the era of development aid in Africa, research efforts have been focused on increasing agricultural productivity mainly through improved technology at the farm level. In spite of such programs, rural household incomes have largely remained low thereby perpetuating the relatively higher poverty level with all its negative consequences notably, low savings, low investment, low productivity and low incomes.

It has now been increasingly realized that real benefits to rural communities are going to come from forward linkages of rural producers to more stable and higher value industrial markets. In turn industry too stands to benefit from increased rural household incomes in terms of higher effective demand for industrial products.

Therefore, this report presents findings on the current state of the Kenyan market for starch, starch-based adhesives and high quality cassava flour for industrial purposes. An assessment of the potential for locally made cassava-based products to substitute for existing raw materials has also been attempted.

KEY FINDINGS

The total market for starch-based products in Kenya is estimated to be over 12,000 MT per annum. A bigger portion, about 60%, goes into the brewery industry. Other major consumers include paperboard, paper and the food sector.

Native maize starch dominates the market for starch. This is mainly produced locally. Modified starches are not significant.

Cassava starch has the potential to substitute maize starch in the paperboard industry. Some of the industry in this sector had used cassava starch before which they found preferable. However, use was discontinued due to inconsistency in quality and erratic supply. The manufacturing costs are high in the local scene because of inefficiencies in the production chain.

At the moment production and supply of cassava starch is low and not timely. This was attributed to higher costs of local production, poor infrastructure and low raw material production

The potential use of cassava in animal feeds has not been exploited in Kenya. This is mainly due to lack of information especially in terms of the processing steps and the rate of substitution of cassava for maize in the commercial animal feeds.

1.0 INTRODUCTION

The economy of most of the developing countries is still largely based on agriculture. However, if agriculture in the developing countries is to contribute to real growth and development in these countries, the link between it and industry has to be developed and strengthened. This would in turn then offer alternative and cheaper sources of raw material to industry while at the same time offer the much-needed internal market to stimulate industrial production.

1.1 Objectives of the study

This study aimed at making a rapid and detailed investigation of the existing industrial markets for starch-based products in Kenya and to assess the potential for cassava based products to replace or partly substitute existing raw materials.

In addition, an attempt was made to identify firms within the respective high priority industries that researchers could work with to achieve market penetration and assess consumer acceptability.

Survey effort was concentrated in the towns constituting the pinnacle of Kenya's industrial base and those around the production areas. These included Nairobi, Mombasa and Nakuru

1.2 Methodology

The design of the survey followed a sub-sector approach and the technique employed involved conducting unstructured and informal interviews in addition to directly observing the critical stages in the production-transformation line wherever possible. Also, sound secondary data sources were relied upon whenever possible.

Prior to the interviews contact with the respective business associations was established and a list of potential firms compiled. Through these preliminary visits, the objectives of the survey and its expected outcome were explained and appointments booked for the primary visits that were to follow. A deliberate attempt was made to contact key informants in each of the categories.

Thus the sample was purposively selected to include respondents from each of the relevant categories identified during the literature review as potential raw material users. Rather than concentrating on numbers, the focus was placed on contacting key firms in the industry in order to obtain a more representative sample.

For each industry to be visited, questions (guidelines) focusing on key production and marketing activities were developed. The semi-structured informal interview guidelines were not written up in the form of a formal questionnaire but they were drawn up as checklists of key issues and topics. Once the survey team was familiarised with the detailed questions of the

original checklist (approx. 7 pages), a shorter version of the latter (i.e. 1 – 2 pages max.) was found useful to stimulate a free-flowing discussion with members of the industries.

Researchers formed two different groups comprising of at least two a technologist and an economist. This combination was found to be very useful both for the research team and the industries visited. It made it possible to understand the relationship between technology and economics and also recent technological developments in the various concerned areas.

A report about each industrial visit made was compiled after the interview, relying on the checklist to make sure that no issue had been overlooked.

It was important that note-taking should not inhibit a free flow of discussion. This effort to keep the interviews informal seemed to encourage frankness on the part of the respondents.

For far away firms, where bookings could not be made by telephone due to various reasons, visits were nevertheless made. This form of “cold-calling” was generally accepted, and useful data was obtained. However, there is a danger that without prior appointment key individuals might be missed. In this case, another visit was obligatory.

Responses from each interview were carefully compared with the responses from other interviews carried out with firms in the same category. This approach was conducted through meetings of the entire research team, which were designed to:

- Ensure that all the collected data had been summarised.
- Identify gaps in the existing information.
- Start forming hypotheses about constraints and opportunities within the marketing system.
- Assess the progress of the survey.
- And design a follow-up of the fieldwork where necessary.

The researchers also used the team meetings to refine their understanding of the roles, responsibilities and links within the production and manufacturing business.

2.0 INDUSTRIAL DEVELOPMENT IN KENYA

Agriculture dominates the economies of sub-Saharan Africa, where it accounts for 70% of total employment and 40% of the total merchandise exports. In this region the contribution of agriculture to GDP is 32%. Agriculture is the mainstay of Kenya's economy, accounting for 26 percent of the gross domestic product (GDP) while manufacturing accounts for about 14 percent. Tea, tourism, coffee, and horticulture in that order are the main foreign- exchange earners (CBS, 1998). In Kenya one to two thirds of manufacturing value added is based on agricultural raw materials (Jaffee, 1995). Many services are linked to agriculture. Food processing, beverage and tobacco industries are among those dependent on agricultural raw materials. Of the industries mentioned, the food processing industry is the single largest component of the manufacturing sector of most African countries.

Since independence in 1963, the country has had mixed performance. In the first 10 years of independence, the country enjoyed high GDP growth rates averaging 6.5 percent per annum, low inflation, high job creation, and a relatively stable balance-of- payments position. During the 1973-1980 period the country's record growth was by three major shocks. The first was the sharp rise in oil prices in 1973, which created considerable internal and external economic imbalance. In 1977-78, the price of coffee and tea rose significantly, which immediately improved the balance of payments position but subsequently created internal economic imbalances. The third shock was in the GDP of 5.2 percent per annum, reflecting a moderate reduction in the high growth rates achieved in the first 10 years of independence. In 1990, growth in the GDP fell to 4.3 percent and 1991 to 2.2 percent; by 1992, it was just 0.4 percent per annum. In 1993, the government introduced more and far-reaching structural reforms, including removal of price controls, removal of all import licensing, and removal of foreign exchange controls. These growth slowed to 4.8 percent in 1996 and declined substantially to 1.2 percent in 1997 (CBS, 1998).

The food industry may be classified into formal and informal sector. The formal sector is classified into large, medium and small scale industries. The criterion for classification is based on the number of employees. Large-scale industrial units have above 50 employees; small-scale industrial units have below 20 while the medium scale industrial units have between 20 and 50 employees. A summary of some of the food industries is given in Table 2 below. On the other hand the informal sector consists of the cottage industry, family and the sole proprietor. After independence and up through the mid-1980's the policies and direct investments of the Kenyan government favoured relatively large-scale industrial units in the food industry and elsewhere. Most of these large scale units were owned by multinationals and some by farmer co-operatives. After the mid 80's the small scale to medium scale industrial units began to mushroom. This is mainly due to the high overheads incurred when running large scale industries. The food for export is processed mainly by the large-scale units while that for local consumption is produced by the medium to small scale industries. The informal sector has proved vital in supplying processed and ready to eat foods to domestic consumers particularly in towns.

The essence of food processing is to produce a high value food product. Processing begins with the articulation of consumer demand and leads to decisions to produce. This continues through the series of activities which produce and subsequently transform the crop or animal product in form, time and place to match consumer demand (Breimer, 1976). In Kenya the best established industry is the dairy industry. This transforms raw milk to pasteurised milk, dry skim milk, butter, cheese e.t.c. Which fetch a higher price. This industry is dominated by the private sector. The development of the commercial dairy production and trade can be divided into five historical stages as listed below.

- ◆ The origins of export oriented butter production (1900-1930's)
- ◆ Discovering the domestic milk market (WW II- mid 1950's)
- ◆ Dualistic development (late 1950's to 1970)
- ◆ Market consolidation and the "publicization" of the private sector (1971- early 1980's)
- ◆ High cost expansion and creeping liberalisation (mid-1980's to present)

Most of the foods processed in Kenya can be historically classified in the same manner except the first two stages.

Table 1. Classification of some the Food processing

TYPE OF INDUSTRY	NUMBER OF INDUSTRIES, GROUPED ACCORDING TO SIZE		
	SMALL	MEDIUM	LARGE
I) FOOD MANUFACTURING			
Slaughtering, preparing and preserving meat	6		3
Manufacture of dairy products	11	4	10
Canning and preserving fruits and vegetables	14	7	1
Canning, preserving and processing of fish	12		
Manufacture of vegetable and animal oils and fats	17	8	1
Grain mill products	42	15	4
Manufacture of bakery products	17	2	4
Manufacture of cocoa, chocolate and sugar confectioneries	11	3	1
Manufacture of food products (N. E. C).	73	52	21
Sugar factories and refineries	7	1	9
Manufacture of prepared animal feeds	25	5	2
II) BEVERAGE INDUSTRIES			
Distilling, rectifying and blending spirits	2	3	1
Malt, liquors and malt	2	1	4
Soft drinks and carbonated waters industries	3	6	5
TOTAL	239	102	66

Much of the new agribusiness investment over the past decade by foreign companies has been made by firms, which had already been established for a long time. Investments have been geared toward diversifying product lines away from commodities facing adverse market trends.

Kenya has witnessed the diversification of foreign owned tea, coffee and sisal companies into horticultural production and trade (Jaffee, 1995).

Gender in the food industry.

charge only of the micro enterprise and the informal sector in food marketing and processing.
 -urban firms including dairy processing are owned and/or managed

company. The Table 2 below shows the ownership of micro enterprises in Kenya by gender. It

also evident that partnerships between men and women is not common.

Table 2. Ownership of micro enterprises in Kenya by gen

Female	
Male	53
	4

Cassava is classified under roots and tubers, which is the class of foods that basically provide roots and tubers refer to any growing plant that stores edible material in the subterranean root, corm or tuber (FAO, 1990).

during tribal warfare and innovations where it was hidden under ground and for saving the
 -Burundi kingdoms in 1943 when potato blight destroyed all their production. It also
 -69.The spread of the cassava was
 ts ability to thrive poor husbandry and to tolerate drought. It originated in tropical America and was introduced in Kenya by the Portuguese and Arab traders (Jones, 1959).

In Kenya as in the rest of Africa, the cassava is usually a subsistence crop grow food and only the surplus is sold. Cassava is consumed as a basic source of low cost calories or as a supplement to cereals. The proximate composition of the cassava is shown in Table 1
 urce of carbohydrate. It has been documented that the cost of cassava is about 25 to 50 percent that of the locally produced

Table 1. Nutritive value of the cassava

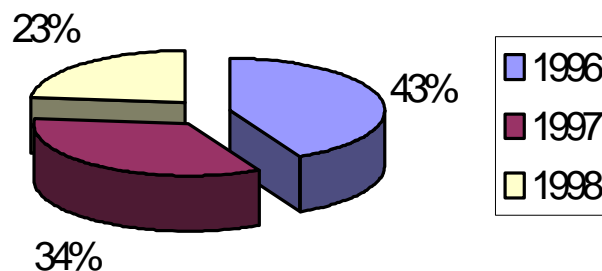
energy kJ	Moisture content %	g	G	Total and fiber	Fiber (g)	Ash (g)	P (mg)	Fe (mg)	K (mg)	Na	Thiamine (mg)	Riboflavin (mg)	-cin	Ascorbic acid (mg)	Folic acid (ig)
565	65.5	1.0	0.2	32.4	1.0	0.9	32	0.9	394	2	0.05	0.04	0.6	34	24.2

Source: FAO, 1972.

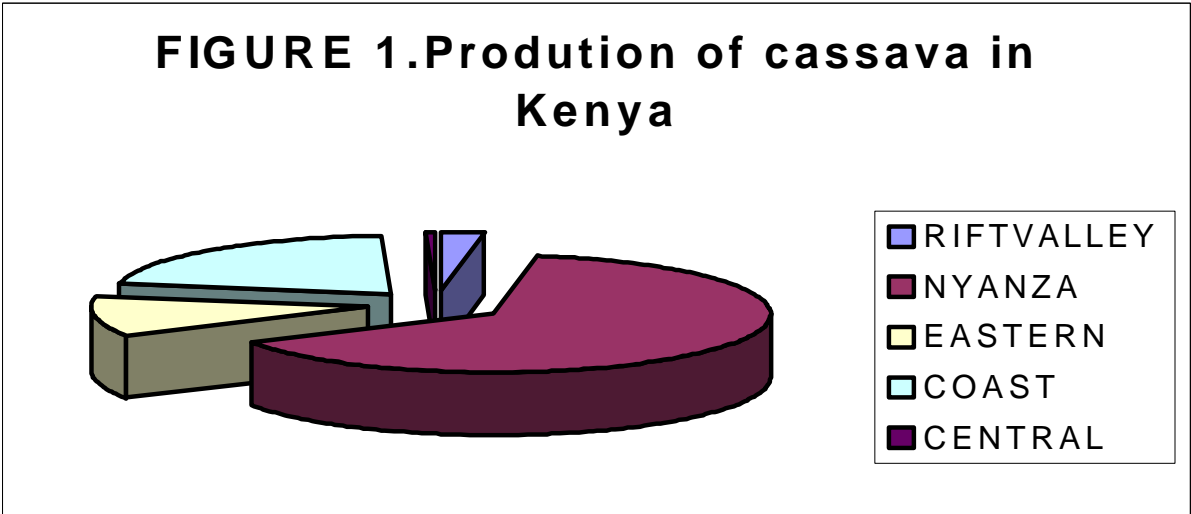
Cassava (*Manihot esculanta crantz*) is one of the major staple foods in Sub-Saharan Africa. It is estimated that Africa produces above 42% of the total tropical world production of the crop (FAO, 1978). Cassava is grown virtually throughout Kenya. However, the Western, Coastal and semi-arid (Eastern) regions of Kenya have the highest production in that order. Traditional utilisation in Kenya is limited to roasting and boiling of fresh roots for consumption in all the growing areas (Khaemba, 1983). In Nyanza and Western provinces of Kenya, roots are also peeled, Chopped into small pieces, dried and milled into flour for ugali. This is normally in combination with a cereal (maize or sorghum). In the Coast province cassava leaves are used as vegetable (Khaemba, 1983). In the Coast province cassava leaves are used as vegetable (Khaemba, 1983) while in Machakos and Kitui, cassava roots are used as a snack.

The bulk of cassava produced in the country is used for human consumption and surpluses are processed in to starch or used for animal feed. However, the present production is adequate for both the demands of starch production and as a food source (Khagram,1983). The market for fresh cassava as a food is more lucrative than for starch extraction but the market for fresh cassava is limited (Karisa, 1983). Fresh cassava has a very short post-harvest storage life, and it must be used or processed into durable forms soon after harvest (Ayernor, 1981). Except for cassava crips, there is no commercial processing of cassava for human consumption. Other products such as deep-fried and sun dried cassava are produced but at a very small scale in the coastal areas. The cassava production in Kenya unfortunately seems to reduce with time as shown by Figure 1 below. This may be because of the high opportunity cost of production.

Figure 1. Production of Cassava over the years 1996 to 1998



Based on the data obtained from the Ministry of Agriculture, Nyanza province produces most of the cassava consumed in the country. This may be because of the cultural acceptability of the crop by the population living in the area. The communities living in this area utilise the crop for various traditional dishes. Central province on the other hand produces the least mainly because in the communities living in the area consider it a non-prestigious crop. The little produced in this area is used as cattle feed.



4.0 CASSAVA MARKETING

In Kenya, cassava is marketed mainly as a fresh root. The marketing of the roots is through village markets situated at the areas of production. Some of it is transported to larger markets situated in the district towns. Processed cassava products are also sold at the markets centres and at residential areas. These processed products include sundried cassava crisps and deep fried cassava. The two latter products are mainly sold in the coastal region. The price of fresh cassava fluctuates depending on the season. In Nairobi for example the price is highest in May and lowest in June.

In the market areas the cassava is marketed as heaps or in bags. There is need to standardise the quantity sold.

5.0 CASSAVA UTILISATION

Fresh cassava has a very short post-harvest storage life, and it must be used or processed into durable forms soon after harvest (Ayernor,1981). Various communities in the region have found different methods of cassava. The main reason for processing other than making the food palatable is to remove the antinutrients in the cassava especially the cyanide.

5.1 CASSAVA CONSUMPTION IN KENYA

5.1.1 INTRODUCTION

Traditional cassava utilisation in Kenya is limited to roasting and boiling of fresh roots for consumption in all the growing areas (Khaemba, 1983). In Nyanza and Western provinces of Kenya, roots are also peeled, chopped in to small pieces, dried and milled in to flour for ugali. This is normally in combination with are a cereal (maize, sorghum or millet). In the coast province cassava leaves are used as vegetable (Khaemba, 1983) while in Machakos and Kitui, cassava roots are used as snack.

The bulk of cassava produced in the country is used for human consumption and surpluses are processed in to starch or used for animal feed. Except for cassava crisps, there is no commercial processing of cassava for human consumption. This could be explored to make it more acceptable to a larger section of the population thereby increasing the demand for cassava products and the income of the farmer.

The following discussion focuses in the preparation of different cassava based food by 7 communities in Kenya.

✠ Embu tribe of eastern province

◆ Mucui

Cassava roots, yams, potatoes and arrowroots are peeled, washed with a lot of water, sliced in to small pieces and mixed with meat. The mixture is fried in oil with onion to taste. Water is added and the mixture is left to boil until cooked. Mucui is served and eaten as a complete meal.

◆ Roasted cassava

Whole cassava roots are peeled, washed, either split in to smaller pieces or left intact as dictated by size, placed on burning embers and left to cook. Once done, the charred bits are scrapped off and the roasted cassava is served with tea.

✠ Kamba tribe of eastern province.

◆ Mukimwa

Cassava roots are peeled, washed, sliced in to small pieces (chips) and mixed with green maize, par-boiled beans, par-boiled cowpeas or par-boiled green grams. The mixture is fried in oil with onions. Water is added and left to boil until cooked. After adding salt Mukimwa is served as a complete meal

◆ Mulikyo

Cassava roots are peeled, washed, sliced in to 2 or 3 big slices and placed in a cooking pot. Water is added and left to boil until cooked. It is served with tea or milk for breakfast.

◆ Raw cassava

This is prepared by peeling, washing and slicing cassava roots in to 4 or more slices. The pieces are spiced with a mixture of salt and ground chilli and eaten as a snack.

✠ Luo tribe of the Nyanza province

◆ Ugali or kuon

Fresh cassava roots are peeled, washed and sliced into chips, which are then sun dried for a period of 1-to2 weeks. The sun-dried chips are then mixed with dried maize, sorghum, or finger millet at the ratio of 2:1 and the mixture is milled into fine flour. The flour is put in boiling water and stirred into a semi-solid porridge called ugali or kuon, which is then served with either, smoked fish, smoked meat or okra soup.

◆ Busaa (a local beer)

Cassava roots are peeled, washed and sliced into chips, placed and stored in a tightly closed darkroom. The cassava is removed from the sack after 1 week and sun dried for a period of 14 days. The dried cassava is then mixed with dry maize and pre-germinated finger millet that has been sun dried for 2 weeks. The mixture is milled in to flour and prepared in to ugali or kuon.

The ugali is broken into small pieces, which are then sun-dried for 3 weeks then milled into flour. The flour is placed in a big earthen pot where 40 litres of water is added, stirred and boiled to produce a light porridge or gruel called Busaa. After cooling, the Busaa is ready for drinking. It has been locally nicknamed two in one; it is a beer as well as a food.

◆ Mariwa

Cassava roots are peeled, washed, split into 2 pieces with the central pith removed and placed in a pot with 1 litre of water (strictly 1 litre to prevent the cassava from absorbing water and becoming watery). Salt is added and the pot is covered with either pumpkin or banana leaves on top of which a metal lid is placed and sealed with cow dung to become airtight. It is left to boil for 30 min after which it should be properly cooked. Mariwa is served with sour milk or milk for either lunch or supper or with tea for breakfast.

3.4 kuogo cassava roots are peeled, washed, placed in a sack or large baskets and stored in a dark cold room for a week. During storage, the cassava roots develop moulds and become soft. The roots are removed from the sacks and crushed in to small pieces, spread and sun dried for a period of 7 to 14 days. The dried roots are mixed with either millet, sorghum or maize and milled in to fine flour which is added in to boiling water, stirred and prepared into either light porridge (nyuka) or thick porridge (ugali). The ugali is served with fish, green vegetables or any stew.

◆ Chapati

The flour obtained in the preparation of kuogo is mixed with wheat flour and kneaded into dough. Small balls of the dough are spread into thin disks, which are then pan fried to produce chapatti. Chapatti is served with tea for breakfast or with fish or any stew for lunch or supper.

◆ Ugali

This dish is prepared for someone going on a long journey. Cassava roots are peeled, washed, sliced into small pieces and dried for 7 to 14 days. The dried pieces are mixed with finger millet at the ratio of 4:1 and milled into fine flour. The flour is added in to boiling water, stirred and prepared into either light porridge (nyuka) or thick porridge (ugali). The ugali may be served with fish, green vegetables or any stew.

✠ Baluhya tribe of western province.

◆ Ugali or Obusuma

Cassava roots are peeled, washed and sun dried for about 6 hours to get rid of excess moisture. The semi-dried roots are heaped in a corner of the kitchen and covered with a sack, a piece of cloth or canvas for a period of 3 to 5 days. The mould formed during this period is scrapped off with a blunt knife and the soft roots are put on a clean floor and crushed with stone in to big soft pieces. The soft pieces are sun dried for a period of 12 to 14 hours. The dried roots are mixed with sorghum, millet, or maize and milled in to flour. Alternatively the dried roots may be milled into flour without any cereal. The cassava: millet or sorghum ratio is usually 4:1 and cassava: maize ratio is 2:1. A cassava: maize mixture is not popular. The flour is added to boiling water and stirred until it cooks into either ugali (thick porridge) or uji (light porridge). The uji is a beverage while the ugali is served with fish, meat or any green vegetable.

◆ Boiled cassava

Cassava roots are peeled, washed, chopped into small pieces, placed in a pot with boiling water and boiled soft or completely cooked. Salt is added during boiling and the dish is served with tea or light porridge.

◆ Roasted cassava

Unpeeled cassava roots are placed on glowing embers until cooked. The roots are peeled and served with a beverage.

◆ Infant light porridge

Cassava roots are peeled, washed, sliced into very small pieces and sun dried for 12 to 14 hours. The dried pieces are ground using stone grinders into very fine flour, which is added into boiling water and cooked into a light porridge. The porridge is then served to young babies.

☒ Maasai tribe of the Rift Valley province

◆ Boiled cassava

Cassava roots are peeled, washed, chopped into big pieces and boiled with water until cooked. The dish is served with tea or milk.

◆ Raw cassava

Raw cassava is prepared by peeling, washing and slicing cassava roots. The pieces are then eaten as a snack in the field.

◆ Roasted cassava

The cassava roots are peeled, placed on glowing charcoal and roasted until cooked. The cassava is served with tea or milk for breakfast.

☒ Kikuyu tribe of the central province

◆ Stewed cassava

Stewed cassava dish is prepared from sweet cassava or low cyanide containing varieties. Cassava roots are peeled, split, sliced into small chips and boiled in water until soft or cooked. The cassava is fried with onion in oil after which water is added and the dish is served with any stew.

◆ Ugali and Ucuru

Cassava is peeled, split, central pith is removed, sliced into small pieces and sun dried for a period of 3 to 7 days. The chips are milled into flour, added into boiling water and stirred to produce either a thick porridge (ngima) or a light porridge (ucuru). Ngima is served with stew while ucuru, a beverage, is served alone.

◆ Cassava bread

Cassava is peeled, split, the centre pith is removed, sliced into small chips and sun dried for a period of 3 to 7 days. The cassava chips are milled in to flour mixed with wheat flour and kneaded into dough from which bread is baked. The bread is served with tea for breakfast or with any stew for dinner.

◆ Roasted cassava

Cassava is peeled, boiled and roasted on charcoal. Alternatively, the cassava is not peeled but placed on burning charcoal and roasted until properly cooked. The charred bits are scrapped off and the cassava is served with tea, milk, any stew or alone.

☒ Coastal people of the coast province

◆ Mashed cassava with milk

Cassava is peeled, washed and cut into small pieces. The pieces are boiled with onions in salted water until done and then mashed together. Milk is added and dish is served.

◆ Cassava meat stew

The meat is washed, cut into small pieces and mixed with curry powder. Onions and tomatoes are cleaned and sliced. Meat is fried with onions until a golden brown colour is obtained. Salt and water are added to the stew. Cassava is peeled, washed, cut into small pieces and added to the meat stew. The mixture is cooked for 30 to 45 min until soft. Tomatoes slices are added 5 min before serving.

◆ Cassava-bean stew (kimanga)

In preparing cassava bean stew one may use cowpeas or grams instead of beans. Beans are cleaned, washed and soaked overnight. Cassava roots are peeled and cut into slices. The beans and cassava slices are boiled together until soft and mashed. Onions and tomatoes are also cleaned, sliced and fried in oil. Salt, pepper and milk are added and the mixture is cooked for a few minutes, seasoned to taste and served.

◆ Cassava-fish stew

Cassava roots are peeled, cut into slices and cooked for 20 min. Fish is cleaned and washed as well as onions and tomatoes, which are sliced. Cups of thick and thin coconut milk are prepared. The fish is put on top of the cassava slices and onions, pepper, tomatoes and coconut milk are added. The mixture is cooked until the fish and the cassava is done. Thick coconut cream is added and ladled over the fish. Season to taste and serve. A similar dish involves frying the fish with onions and tomatoes in a little oil. These are put on top of the boiling cassava and groundnut flour is added instead of the coconut milk. The juice of one lemon is also added. Dried fish could be used instead of fresh fish.

◆ Cassava leaves

Cassava leaves are washed, pounded and boiled in salted water for 60 min. Onions and tomatoes are cleaned, sliced and fried in oil. Curry powder, coconut cream and the cassava leaves are added. The dish is ready to be served with any carbohydrate.

◆ Cassava pudding

Grated cassava roots are mixed with grated coconut and sugar. A banana leaf is cut in to two big pieces and softened over fire. Half of the cassava mixture is put on one piece of the banana leaf, folded and tied. The other package is prepared in a similar manner. Both packages are put in a greased tin or a small pan and baked in a moderately hot oven until brown. The cassava pudding could either be served hot or cold. A variation in a similar dish involves steaming the pudding instead of baking and groundnut flour could replace the coconut cream

◆ Fried cassava

Cassava roots are split into 5-6 pieces and deep-fried in oil. The cooked cassava pieces are spiced with salt, pepper and lime or lemon to required taste. The dish is served and eaten as a complement to another meal or as a snack.

5.2 CASSAVA UTILIZATION IN UGANDA

5.2.1 INTRODUCTION

Cassava is a very important food especially to the low income group of people in Uganda. The traditional methods of processing cassava are boiling, baking, frying, sun drying, and either hand grinding or milling. Cassava can also be prepared mixed with broad beans, peas and sometimes meat. Composite flour is also produced usually consisting of cassava flour mixed with millet, sorghum or maize (corn). The main method of processing cassava is boiling. However, composite flour consumption is also significant and is the major method of cassava preservation.

5.2.2 Preparation of cassava products

❖ **Boiled cassava ('mogo' 'otedo' muwogo')**

Fresh cassava roots are peeled, washed and boiled in water for 20-40 min until cooked. Mostly urban people may add spices, whereas the village inhabitants added salt to the cooking cassava. Some other foods like groundnuts stew, simsim paste, broad beans peas and, at times, meat were added to the cooking cassava and the mixture was called Aputta in Lira and Apach, whilst in Iganga it is called katogo.

❖ **Cassava paste ('kwonmogo' 'chawda')**

The cassava roots are peeled, sliced and then dried in the sun on mats, flat rocks, or specially prepared ground smeared with cow dung to reduce dust and dirt. The drying takes about 3-4 days, and the dried chips are then stored in old tins, baskets or granaries. When the paste is required, the chips are pounded then ground into flour, and added to boiling water with mixing until a consistent paste is obtained.

❖ **Cassava flour mixed with millet and sorghum ('kwon kal' kwonbel' 'obuita' 'mutama')**

Cassava flour was mixed with either millet or sorghum and then a paste was prepared as in pure cassava paste. One part of sorghum was added to 2 parts of cassava and ground into flour; the resulting paste was called mutama. Millet was mixed with cassava and ground into flour; the resulting paste was called obuita. When one part of cassava is mixed with 4 parts of millet, the resulting is called kwon kal, whilst one part of sorghum added to 2 parts of cassava results to kwon bel. Some districts fermented cassava (obtained by slicing fresh cassava into chips and leaving them covered in a cool place for a day or 2 until the chips are slightly mouldy) for this use in which case the amount of cassava was reduced, and some people preferred this because of the flavour it imparted to the resultant paste.

❖ **Roasted cassava ('mogo obulo' 'muwogo mwokye')**

Cassava roots were placed in hot ashes or charcoal for 20-30 min. Roasted cassava was popular among school pupils who used it as a snack in school.

❖ **Fried cassava ('mogo ocelo' 'muwogo musike')**

Fresh cassava roots were peeled, washed, cut into small pieces and then deep-fried in oil.

5.3 FOOD TYPES PREPARED FROM CASSAVA IN THE SIX COSCA STUDY COUNTRIES.

5.3.1 COOKED FRESH ROOTS

❖ **Roasted cassava**

The simplest way of preparing fresh cassava roots is roasting whole roots of sweet cassava varieties in the coals of burnt down fires. The burnt peel is scrapped off when the root is cooked and the white steamed inner part of the roots is eaten alone or with palm oil or stew. The taste of roasted cassava is influenced by the length of time the roots remain in the ground before harvesting, and the variety of sweet cassava used

❖ **Boiled cassava**

The roots from low cyanide varieties may be boiled fresh after peeling, washing and cutting into small pieces. The pieces are usually submerged in boiling. Boiling in large quantities of water reduces or eliminates the small quantity of cyanide, which is also present in the fresh roots of sweet varieties. Boiled cassava is eaten with stews or vegetable soups.

❖ **Soaked boiled cassava**

Another variation of boiled cassava that is mainly a storage technique, is the 'wet abacha' found in eastern Nigeria. After the cassava has been boiled, the water is poured off and the boiled pieces are covered in cold water and kept in a cool place. Abacha is eaten as a part of the main meal. By changing the water everyday, the boiled cassava can be stored for 2-3 days before fermentation begins.

5.3.2 CASSAVA FLOURS

❖ Unfermented cassava flours

The roots are peeled and cut into small chips immediately after the harvest and spread in the sun for drying. In dryer climates, like in northern part of Ghana, the chips may sundry in only a few hours. During the rainy season the chips are dried over the fireplace in the house. Roots or cuttings dried in the smoke need to be cleaned and scraped before milling in order to obtain nice white flour. The traditional methods for milling are pounding in a mortar or grinding on a grinding stone.

❖ Fermented flours

The fermentation of cassava before it is dried and milled is common where bitter cassava varieties are more important than the sweet varieties. Whole cassava roots are submerged in water from 3 to 5 days depending on the taste desired and the taste and the weather. A longer fermentation produces a sour tasting flour, which is preferred in some regions. Fermentation is also faster in hotter climates...the colour of the flour depends on the time used for sun drying. If the drying is not finished the same day, the product may start to ferment again or get mouldy. To shorten the drying time the fermented roots may be put in bags or baskets and pressed with stones or a screw press to remove excess water. In east Africa, fermentation is sometimes done in heaps without adding water.

5.3.3 GRANULATED CASSAVA

Roasted or gelatinised granules (gari)

Gari is prepared by fermenting grated fresh cassava in sacks, squeezing out the excess water, and then frying the semi-dry granules in a minimum amount of oil to prevent sticking until a gelatinised crust forms. Yellow gari results from using palm oil to fry the raw grated chips. The longer the period of fermentation the more sour the taste of gari. Grating is either done manually or mechanically, with diesel-powered rotating grating machine. Grated wet cassava is then bagged or put in baskets and pressed to remove excess water in a variety of ways: from stones on wooden frames to hydraulic presses. Frying is usually done in large round earthen pots or iron pans. The end product can be stored up to three months in plastic bags or other containers.

Gari can then be reconstituted with hot water and stirred to form a thick paste and eaten with soups and stews; it can also be mixed with cold water/milk and sugar and drunk as a snack.

5.3.4 COOKED GRANULES

Steamed fermented granules (atieke).

Atieke are cassava granules, which are steamed after they have been mashed, fermented, dewatered granulated and semi-dried in the sun. Four different methods exist for the production of starter cultures used for the fermentation of the cassava roots: boiling, roasting or cutting fresh roots which are fermented for three days; a fourth method uses a filtrate from

cassava which has been boiled, pounded and squeezed. These starter cultures are added to fresh cassava during the mashing and influence the taste and the quality of the end product. After fermentation and dewatering, the mash is pressed and rolled to produce a uniform granule, sieving or winnowing may further improve it. In Cote d' Ivore, atieka is eaten directly after steaming with stews and soups. The Hausa in Nigeria use pressed, sieved and fermented cassava granules mixed with onions, tomatoes and spices, to form cakes, which are then deep-fried in oil. These cakes are called kwosai and are eaten as a full meal or as a snack between meals.

5.3.5 FERMENTED PASTES

Boiled fermented pastes

The most common characteristic of this is the white colour and smooth texture of the boiled cassava pastes. Essential steps in preparation include, peeling, washing, (grating or cutting into finger-like pieces) fermenting in water, mashing and squeezing through a fine cloth or sieve. This raw paste is then boiled in water or steamed in wrapped leaves. The normal fermentation period is from 1 to 3 days, however in Ghana, the grated cassava is fermented for 7 days. Longer periods of fermentation result in a more sour taste, which is preferred by some consumers. After dewatering the fermented cassava is pounded into a fine paste, which is filtered through a cloth. The filtrate is settled and boiled in water and eaten with stews and soups. The sediment may be stored up to 8 days, depending on how long the cassava was fermented. The longer fermentation is positively related to longer storage ability.

5.3.6 SEDIMENTED STARCHES

❖ Tapioca

Cassava starch is made by peeling and grating fresh roots and stirring them in water in order to separate the fibre from the starch. The particles are allowed to settle on the bottom of the container, where it forms a white muddy cake. The water is then carefully skimmed off, and the cake is removed and further dried in the sun. The semi-dried starch may be roasted in iron pads until is completely dry to form tapioca. These granules are about 1 cm in diameter and can be eaten as a snack, or boiled as porridge. Alternatively the sun dried starch cakes can be pounded or milled into fine flour, which is used as a thickener in soups and stews.

❖ Laundry starch

Where cassava is being processed into gari on a large scale the water, which is pressed out during fermentation, is collected in large basins and allowed to settle. The starch so formed is not considered clean enough to eat and is used as laundry starch.

5.3.7 DRINKS WITH CASSAVA COMPONENTS

Cassava is used as a substitute for maize and other grains in the preparation of local brews. Cassava is also mixed with cereals to stretch out supplies and still arrive at a product, which resembles the original cereal based beer. Consumers generally give priority to high alcohol content over taste. The type of yeast used influences the quality of the end product, especially in the brewing of local beer. The taste of distilled drinks is less affected by raw materials and

therefore the proportion of cassava used can be high. Many different cassava products can be used, and even the lowest quality products still ferment to alcohol, such as flours, which are not properly dried or have become off-coloured.

5.3.8 NON-CONVENTIONAL FOODS

Product development especially in the line of production of me too products have been engaged in order to facilitate the utilization of the cassava by creating more outlets. Some of the nonconventional foods prepared from cassava include balanced foods, vegetable cheese processing, fortified sago and starch products, noodles and Vermicelli, nutritious food mixes, gold finger, cassava Rava, putto, Biscuits and cakes.

6.0 Starch.

Starch exists as the major reserve carbohydrate of higher plants, where it is generally deposited in the form of minute granules or cells ranging from 1 up to 100 μm or more in diameter. Chemically, it is a polymer of glucose units joined by α linkages. The α linkages, being less stable compared to β linkages of cellulose render the starch relatively liable. Starch exists as two polymers namely Amylase and Amyl pectin. Both polymers are made up of α -D-glucopyranose units, the major component – amylopectin- has a branched structure while amylose, the minor component, has a linear structure.

Most of the world's starch supplies are derived either from grains (corn, sorghum, wheat, rice), the major root crops (potato, sweet potato, cassava, arrow root), or the pith of the sago palm. Since time in memorial various communities using traditional methods have produced starch. The development was based on the observation that a white insoluble granular material settled to the bottom when quantities of cut tubers were washed. A classical example is seen in the extraction of starch to prepare pot bammie by the Jamaicans. The steps taken in the production of pot bammie include: grating the cassava and mixing this with water, straining the pulp through a towel, allowing the mixture to settle, decanting the water, sun drying the starch and finally baking it (FAO, 1990).

6.1 Production of starch

Starch was separated from other grains and from root vegetables such as potatoes long before corn was used as a raw material (Matz, 1970). John Biddies set up the first starch factory in the United States at Hillsborough, NH in 1802. He used potatoes. In 1842, Thomas Kingsford founded the cornstarch refining industry. He was the first person to extract starch from maize on a commercial basis.

6.1.1 Cassava starch.

There are many sources of starch and for the cassava starch to obtain a profitable and sustainable market share it must compete with other starches in terms of relative prices, quality and dependability of supply (Goering, 1979). It is therefore important to study its properties so as to market it appropriately. Its bland flavour, low amylose content, non-retrogradation tendency and excellent freeze-thaw stability makes it suitable for use in food processing (FAO.1990). When used as an adhesive it produces joints with high tensile strength and is hence preferred to starch (Balagopalan *et al.*, 1988).

6.1.2 Cornstarch

The process initially used to extract starch on a commercial basis can be summarized as follows. The corn was placed in wooden, flat-bottomed tank covered with warm water and allowed to stand. After the corn was sufficiently softened it was ground in stone mills, sieved and washed on silkscreen shakers powered by reciprocating engines. The slurry that was washed through the sieves was poured in wooden tubs, treated with caustic soda and allowed to settle. After settling, the water was sent to the sewer, taking all the gluten and soluble materials with it. This settling

process was repeated three times for each batch. The starch recovery could not have been more than 50% of the total starch available.

Modern efficient corn refining plants, which do not empty other valuable products down the drain, are today in use. These in addition have laboratory facilities. In these refining plants the wet- milling process is used. The flow diagram of the wet milling process may be summarized as shown on Figure 3 below.

Cleaning operations.

These involve passing the corn past powerful magnets, which remove metallic objects, which may have been introduced by previous handling. The cleaned corn is weighed on screen hoppers and sampled for quality. After sampling the corn is then cleaned by passing it over perforated screens. The upper screen has holes just large enough to let corn and smaller particles through and the lower screen holds back the corn, but lets cobs, sticks and stones through. High pressure is then used to separate the corn from other debris by density in cyclones.

Steeping.

The cleaned kernels are transferred to “steep” tanks and soaked for 36 to 48 hrs at about 120° to 130 °F. The water used contains some sulfur dioxide, which prevents germination and keeps down unwanted fermentation and other undesirable microbiological changes but permits growth of lactic acid producing bacteria. So as to minimize the cost of production due to water used and to prevent pollution and wastage of raw materials, steeping is carried out in counter current flow. The incoming water passes over the corn, which has been steeped the longest, ensuring removal of the maximum amount of soluble material. The steep water is then concentrated to 54% dry matter.

Degermination

After the steeping process the corn is now ready for the first milling operation degermination. De-germination, separates the oil rich germ from the starch, gluten, hulls, and fiber. The soft corn is then ground in attrition mills. The slurry from the mills, which consists of endosperm, germ, and fiber, is diluted with a carefully controlled amount of process water. This is then fed to a battery of hydrocyclones. The germ being lighter spins off the top, and the heavier endosperm and fiber flow out the bottom. The germ is then washed free of starch, dewatered and dried.

Separation of hulls and fiber from starch and gluten. The wet mash of fiber, hulls, gluten and starch, which remains on the reels and shakers, is fed to mills, which grind the materials to a very small particle size. The reduction in size is differential due to the nature of the materials. The hulls and the fibers are not reduced in size as much as the starch and the gluten in the milling process. The fiber and hull is then separated from starch and gluten by screening over a series of D.S.M (Dutch Slate Mines) screens.

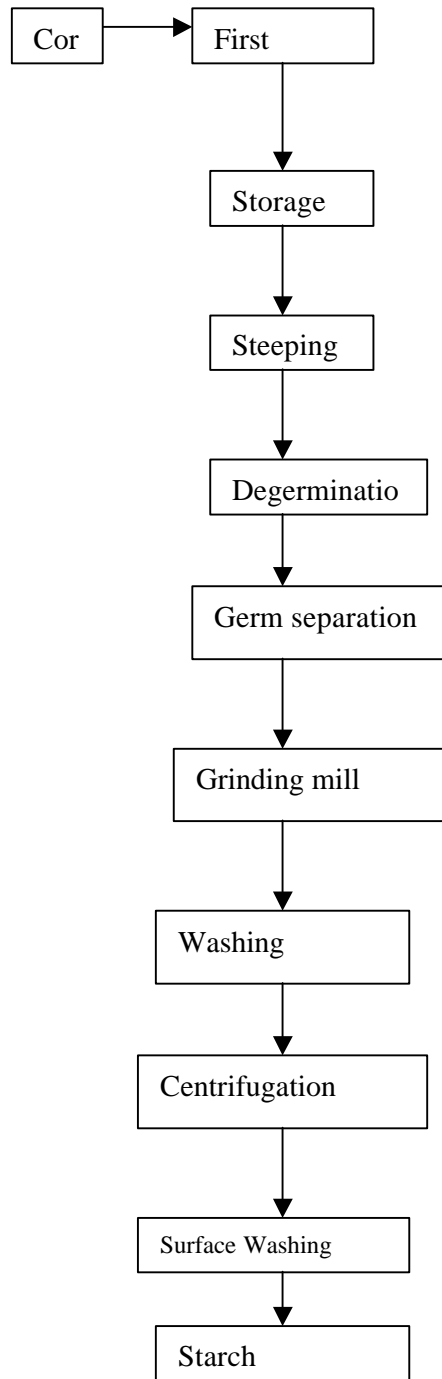
Gluten-starch separation.

Starch and gluten are separated using gravitational methods. Centrifugation is used in the separation process and the two products flow out of the centrifuge in two streams. Starch and

gluten streams. The starch stream contains about 1 to 2 % protein and is purified to contain less than 0.3 % protein by passing it through many small hydrocyclones. In addition the starch is washed to remove the last traces of solubles

The wet starch is dewatered on rotary vacuum filters, moving belt filters or basket centrifuges. The final drying takes place in tunnels (kiln) dryers, continuous belt hot air dryers, or in spray dryers

The gluten after centrifugation is either separated by sedimentation in large tanks or more generally, is de-watered and de-starched in another centrifuge filtered and dried. It is then ready to be used as corn gluten meal or corn gluten feed, or processed to recover the protein, seen, which has many non feed uses (Matz, 1970).



6.2 HISTORY OF STARCH PRODUCTION IN KENYA

Tapioca starch factory

CPC starch factory

Starch importation data from KRA

Starch exportation data from KRA

7.0 SURVEY FINDINGS ON CASSAVA STARCH

7.1 RESULTS AND DISCUSSION.

Tapioca Limited Mombasa is the major cassava starch producer in the country. It currently produces ----- tones of cassava starch per year. In addition produces starch-based adhesives (SBA). The raw material – cassava roots is purchased locally from the neighboring coastal areas. The key manufacturers utilizing the cassava starch encountered in the survey are Goshrani printers, who utilize cassava based glue and Packaging Manufacturers (1976) Ltd. Mombasa who, utilize 1 tonne of cassava starch per month. The cassava starch is higher priced than the cornstarch in this country. The survey findings show that the cassava starch is sold at 40 Kenya shillings per kg, while cornstarch sells at 35 Kenya shillings per kg.

It is evident from the survey results tabulated on the Table 3 below that the price of the cassava starch is not the only constraint limiting it from reaching its utilization potential in Kenya. Other constraints include its high cost of production especially due to the large quantity of water required. This may be reduced by counter-current flow of water and other cost reducing measures.

Table 3. The results of the survey findings on cassava starch.

Organisation & Key contact	Basic Information	Relation to Cassava	Current Situation	Next Steps	General Remarks
<p>Atta (Kenya) Limited P.O. Box 83272 Mwangeka Road, Mombasa Tel: 005-11-490864/5 Cellular: 005-72-410126 Fax: 005-2-490534 E-mail: attakltd@Net2000ke.com Contact person Rahim Lalji Marketing Manager</p>	<ul style="list-style-type: none"> • One of the major millers in Mombasa • Main products include wheat and maize flour 	<ul style="list-style-type: none"> • Does not process cassava flour 	<ul style="list-style-type: none"> • Only processes wheat and maize flour 	<ul style="list-style-type: none"> • Firm thinks cassava flour cannot work in bread due to taste and quality 	<ul style="list-style-type: none"> • Sensitise the public on the value of cassava This is a long term goal
<p>Carlton Products Ltd. P.O.Box 78105, Nairobi. Tel: 02-55667. Contact: Raj Kutecha.</p>	<ul style="list-style-type: none"> ◆ Producers of beverages and cooking aids 	<ul style="list-style-type: none"> ◆ They do not use cassava starch 	<ul style="list-style-type: none"> ◆ Corn starch is used as carrier in cooking aids ◆ Starch is bought at CPC at KShs33/kg ◆ Requirement is approx. 1MT/month 	<ul style="list-style-type: none"> ◆ They need information on the potential use of cassava starch in their industry 	<ul style="list-style-type: none"> ◆ Workshop to train on uses of starch ◆ Could use starch if the application could be demonstrated
<p>Carton Manufacturers Ltd. Mr Singh Tel: 540687 Visited by; Jagwe, Githaiti</p>	<p>The factory was established 25 years ago</p>	<p>none</p>	<p>The factory utilises 250 tonnes of maize starch per year and it is all purchased locally at a cost of Ksh 45 per Kg (factory del.)</p>		

Marketing opportunities for cassava based products

<p>Cartubox Industries EA Ltd. K.I.Estates Nakuru Tel: 037 215997 cartubox@todays.co.ke</p> <p>Mr Njoroge Managing Director</p> <p>Visited by; Jagwe, Githaiti</p>	<p>They manufacture corrugated cartons, beehives and mineral water.</p> <p>The raw materials used to make the adhesive for the boxes are Starch, Caustic soda and Borax</p>	<p>Cassava starch was once used but it produced a yellowish product that was undesirable.</p>	<p>1 tonne of maize starch is utilised per year and it is purchased from CPC at a cost of Ksh.39 (ex.Factory)</p>	<p>A 1 Kg. sample could be availed</p>	<p>Cassava starch could be used if the issue of colour is rectified and if the cost is attractive</p>
<p>Centrofood Ltd P.O.Box 1068, Thika. Tel: 0151-21780. Fax: 0151-21982 Contacts: Mr. Mburu; Mr. Ndirangu</p>	<p>◆ They produce juices and jams</p>	<p>◆ They have not used cassava starch</p>	<p>◆</p>	<p>◆</p>	<p>◆</p>
<p>Chandaria Industries Limited. Baba Dogo Road, Ruaraka, P.O. box 30621 Nairobi. Tel: 802252/3/4/5 Contact person Mr. K.V. Bhatt, General Manager-Projects</p>	<ul style="list-style-type: none"> The firm was not using any cassava based products 	<ul style="list-style-type: none"> It currently uses 100 tonnes of starch per year. It uses maize starch 	<ul style="list-style-type: none"> Could explore possibility of replacing maize with cassava starch 		

Marketing opportunities for cassava based products

<p>Continental Products Ltd. P.O. Box 13458, Nairobi. Tel: 02-530766. Fax: 02-530712. Contact: Mr. Kariuki</p>	<p>◆ Producers of glue</p>	<p>◆ They do not use starch ◆ They are willing to use cassava starch for the superior adhesive quality</p>	<p>◆ Users of corn starch ◆ Requires about 1-2 MT/month ◆ Purchase from CPC at KShs35/kg</p>	<p>◆ Could try cassava starch for its superior adhesive quality</p>	<p>◆ Need information on resourcing ◆ Potential users of 100 % starch</p>
<p>Corn Products Kenya Ltd. P.O. Box 1012 Eldoret Tel: 0321 32511-6 Fax: 0321 33476 Mrs Monica Ragui Customer Service Manager Visited by; Jagwe, Githaiti</p>	<p>This is a multinational company with sister companies all over the world. The following are the products manufactured; -Maize starches (medical grade, natural grade) -Glucose Syrup The following bi-products are also produced; -Animal feed ingredients -Maize germ for oil extraction -High protein meal - The company imports starch</p>				<p>It would be necessary to change the entire production line if cassava starch is to be produced. The decision to make cassava starch has to be made by the directors. NB Management does not favour the publication of any figures in terms of quantity or price of products manufactured</p>

Marketing opportunities for cassava based products

	based glue and Cora gum from its sister companies in S. Africa				
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Marketing opportunities for cassava based products

<p>Dais Bakery (1996) Ltd Arch Bishop Makarios Road P.O. Box 82802, Mombasa Keny Tel: 005-11-230494/5/6/7 E-mail: daisbak@swiftmombasa.com Contact person Kamal Shah, Director</p>	<ul style="list-style-type: none"> • This is a big bakery in Mombasa • It also manufactures biscuits 	<ul style="list-style-type: none"> • In the past tried to use cassava flour due to shortages of wheat flour on the market • However the percentage of fiber was too high and far above the recommended figure • At the moment its no longer using cassava flour • The product made of cassava was not of good quality • It obtained the cassava from Tapioca 	<ul style="list-style-type: none"> • Currently using wheat flour in both bread and biscuits • Using about 500 bags per day for bread and 100 bags per day for biscuits • The main market is Mombasa and the surrounding areas 	<ul style="list-style-type: none"> • This bakery is currently faced with stiff competition from new firms coming into the market and is therefore willing to try cheaper alternatives • Its hence willing to use the recommended percentage for cassava flour in bread 	<ul style="list-style-type: none"> • Provide the correct information • Provide the quality sample • Test the product on the market • This is one of the few firms in the bread industry that might provide a serious partner in product developing and market penetration • It might be a good idea to work with a few firms in the bread industry so that others may follow
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Marketing opportunities for cassava based products

<p>East African Packaging Industries Ltd. Kitui Road, Off Kampala Road, P.O. Box 30146, Nairobi, Kenya Tel: 530176/7/8/9 531337/8/9 E-mail: it_eapi@africaonline.co.ke Contact persons: William K. Gacheru, Factory manager Muchiri Tel: 005-733-734053 Mutua Tel: 005-72-725678</p>	<ul style="list-style-type: none"> • Its one of the major factories making corrugated boxes in the country • It mostly sells into the local market • It also exports boards to Uganda through its sister company PPL • It accounts for about 25% of the starch used in paperboard industry • On average it utilises about 30 to 35 tonnes of maize starch per month. 	<ul style="list-style-type: none"> • Has used cassava starch before • Cassava starch was abandoned due to inconsistency in quality • Cassava starch was being got from Tapioca in Mombasa • However, had found cassava starch better than maize starch as it would give more mileage • Therefore willing to shift back to cassava starch if reliable supplies can be assured 	<ul style="list-style-type: none"> • Currently using maize starch which is obtained from CPC in Eldoret • The cost of maize starch is 35 Kenya shillings per kg delivered to the factory • The firm produces about 1200 tonnes of paperboard per month. • Specification for maize starch is as follows: Moisture - 11.5 to 12.5% Appearance - white Starch content 87-88% Ash 0.25 - 0.35% Protein 0.5 - 0.7% pH 4-5 Shelf-life 12 months Packaging - 50 Kgs 	<ul style="list-style-type: none"> • Interested in using cassava starch • Would like to get technological data on use of cassava • Is not aware whether cassava flour can work and is therefore willing to try it out • Specification for cassava products were as follows: Appearance - white Starch content 86 - 87% Moisture content 12.5 - 13.5% Fibre content < 0.2% Protein < 0.1% pH 5.0 - 6.0 Shelf-life 12 months Packing 25 kg 	<ul style="list-style-type: none"> • Should get information on whether cassava flour can actually work Otherwise needs to get information where can obtain reliable supplies of cassava starch at a competitive price
<p>Golden Biscuits (1985) Ltd. Mr Anthony Tel: Visited by; Jagwe, Githaiti</p>	<p>Probably the 3rd largest biscuit manufacturer in Kenya They make Ice cream cones too</p>	<p>None</p>	<p>-Utilises 2,000 tonnes of wheat flour p.a. at a cost of Ksh 33 per Kg (factory del.) -60-70% of the wheat is imported</p>	<p>They are not willing to try out a sample due to high risk of loss however they would like to taste a product where cassava has been used as part of the ingredients</p>	<p>-Cheaper imported biscuits from S. Africa are causing serious competition</p>
<p>Goshrani Printers Contact person Goshrani</p>	<p>Major stationery factory in Mombasa</p>	<p>At the moment uses cassava based glue</p>	<p>Uses about 100 kg of cassava based glue Glue obtained from Tapioca in Mombasa at a cost of 40 Kenya shillings per kg</p>	<p>Firm insists it uses very small quantities</p>	
<p>Henkel E.A. Ltd. Outer ring Rd. Ruaraka Nairobi</p>	<p>Manufacture adhesives and cosmetics</p>	<p>none</p>	<p>At present they use 12 tonnes of maize starch per year and</p>	<p>2 Kg sample of cassava starch could be availed for trials</p>	<p>The usage of any kind of starch beyond 4% as an ingredient causes the</p>

Marketing opportunities for cassava based products

<p>Andrew Okeyo Technical Director</p> <p>Visited by; Jagwe, Githaiti</p>	<p>Starch is used increasing viscosity and wet tag and it is mostly used in ice-water resistant adhesives</p> <p>300 tonnes of adhesives are manufactured per year</p>		<p>this constitutes 4% of the ingredients used in making adhesives.</p> <p>The maize starch is purchased from CPC</p>		<p>shortening of the shelf life of the adhesive.</p>
<p>House of Manji Likoni Rd. Ind. Area Nairobi</p> <p>Tel: 535064, 545827, 555944 Fax: 541694 info@houseofmanji.co.ke</p> <p>Mr. Francis Nyamboka Quality Assurance Manager</p> <p>Visited by; Jagwe, Githaiti</p>	<p>Probably the leading biscuit manufacturer in Kenya. They also make Weetabix, Pasta, Unimix and fambics</p>		<p>They utilize 8,000 tonnes of wheat flour per annum at a cost of Ksh.29.5 per Kg. (cif Nairobi)</p> <p>They also utilise 6,000 tonnes of maize flour per annum and about 2,000 tonnes of Soya flour while making Unimix</p>	<p>A sample of high quality cassava flour and cassava starch could be availed for trial.</p>	<p>Availability, cost, energy content and fibre content should be taken into consideration.</p>
<p>Jambo Biscuits (Britania) 1987 Ltd</p> <p>Mr Shetty General Manager Tel: 540698, 556613</p>	<p>-Among the two largest biscuit manufacturers in the country</p>	<p>none</p>	<p>9,000-10,000 tonnes of wheat flour are utilized per annum.</p> <p>Wheat is purchased locally and some imported from</p>	<p>Management expressed a desire to carry out tests with high quality cassava flour and cassava starch</p>	<p>The management was very much concerned with the following aspects of cassava namely; shelf life, fineness, taste, texture, gluten content, moisture & protein content and the availability of</p>

Marketing opportunities for cassava based products

<p>Fax: 545660 britania@swiftkenya.com</p> <p>Visited by; Jagwe, Githaiti</p>			<p>S.Africa</p> <p>Some starch is used in the process of making biscuits to improve taste and texture. About 12 tonnes of maize starch is used per annum at a cost of Ksh.40-45 per Kg.</p> <p>It is usually purchased from CPC (K) Ltd.</p>	<p>A sample should be availed</p>	<p>and the availability of cassava.</p>
<p>Jetlack Foods K. Ltd. P.O. Box 46238 Nairobi. Tel: 0151-54387. Contact: Mr. Bid; Mr. Shroff</p>	<ul style="list-style-type: none"> ◆ They specialise in production of juice, sauces etc 	<ul style="list-style-type: none"> ◆ They have not used cassava starch 	<ul style="list-style-type: none"> ◆ They use about 1MT/Month ◆ Use only modified starch from CPC at Ksh 36/Kg ◆ They also use dextrose monohydrate and liquid glucose 	<ul style="list-style-type: none"> ◆ They would like to try to use cassava starch in products 	<ul style="list-style-type: none"> ◆ Supply some starch samples for trial ◆ Quality and price must be reasonable
<p>Kenafriic Bakers Ltd. P.O.Box 42056, Nairobi. Tel: 0151-55467. Contact: Mr. Mukesh Shah.</p>	<ul style="list-style-type: none"> ◆ The business is in bread making 	<ul style="list-style-type: none"> ◆ They do not use cassava flour 	<ul style="list-style-type: none"> ◆ They purchase bakers flour directly from millers ◆ They produce 10,000-200,000 loaves/day 	<ul style="list-style-type: none"> ◆ They are willing to try composite flour 	<ul style="list-style-type: none"> ◆ Try the composite flours ◆ Obtain samples of flour ◆ They are concerned about the keeping quality, pricing, and acceptability of cassava flour products.
<p>Kenblest / Kifaru Textile Mills</p>	<p>They make fabrics and</p>	<p>none</p>	<p>Starch is not</p>	<p>none</p>	<p>There are no prospects for</p>

Marketing opportunities for cassava based products

<p>Ltd., P O Box 581 Thika</p> <p>Tel: 0151 21671-5 Fax: 0151 21752</p> <p>Mr Jeje Mills Manager,</p> <p>Visited by; Jagwe, Githaiti</p>	<p>garments but using 100% polyester.</p> <p>When synthetic fibres are used, starch cannot bind to them hence is not required in any process. Starch can only bind to natural fibres.</p>		<p>required</p>		<p>cassava starch</p>
<p>Kenya Breweries Ltd P.O.Box 30131 Nairobi. Tel: 02-864423. Contact: Mr. ??/Ng'ang'a Cege</p>	<ul style="list-style-type: none"> ◆ Beer brewing is their main business 	<ul style="list-style-type: none"> ◆ They have not used cassava starch 	<ul style="list-style-type: none"> ◆ They use maize starch from CPC as an adjunct in the mashing process ◆ They use about 10,000 MT/Annum 	<ul style="list-style-type: none"> ◆ This would be a heavy user of cassava starch if they could be assured of the quality implications 	<ul style="list-style-type: none"> ◆ To try using cassava starch to replace corn starch ◆ The market is declining ◆ They would be concerned about the gelatinization temperature ◆ They would also be concerned about the filtration and handling steps in production
<p>Kenya Cold Storage Ltd. P.O.Box 41229 Nairobi. Fax: 02-331819;Tel: 02-226165 Contact: Mr. Nurez Kurji</p>	<ul style="list-style-type: none"> ◆ Have been well established in handling meats/meat products 	<ul style="list-style-type: none"> ◆ Does not use cassava starch 	<ul style="list-style-type: none"> ◆ Uses corn starch as sausage filler ◆ Consumes 5-10 MT/annum ◆ Local purchase from CPC 	<ul style="list-style-type: none"> ◆ Would like to have cassava starch for tests 	<ul style="list-style-type: none"> ◆ Obtain information ◆ Obtain sample

Marketing opportunities for cassava based products

<p>Kenya Orchads Ltd P.O.Box 45065 Nairobi. Fax:02-537479, Tel:02-541231. Contact: Mr. Jolly Thomas</p>	<ul style="list-style-type: none"> ◆ Well established in fruit juices, Jams, canned fruits/vegetable 	<ul style="list-style-type: none"> ◆ Have not tried cassava starch 	<ul style="list-style-type: none"> ◆ Consume 25-30MT/annum ◆ Starch as a soup thickener ◆ CPC local supply ◆ Costs Kshs. 32/kg ◆ Also uses glucose syrup 	<ul style="list-style-type: none"> ◆ Interested in trying out cassava products 	<ul style="list-style-type: none"> ◆ Information on cassava products ◆ If no functional difficulties cassava products could be used to replace corn products
<p>Milly fruits Processors Limited P.O. Box 90522 Mombasa Kenya Tel: 005-2-485551/486357 Cellular: 005-72-411608 E-mail: fruits@millygroup.com</p>	<ul style="list-style-type: none"> ● It's the largest fruit processor in Mombasa ● Buys fruits from local producers 	<ul style="list-style-type: none"> ● Does not use cassava starch 	<ul style="list-style-type: none"> ● Uses maize starch from CPC ● Uses small quantities i.e. 100 kg per month 		
<p>Mini Bakers Ltd. Oslo Road. P.O.Box 17592, Nairobi. Tel: 02-544845 Contact: Mr. Pai/Ghosh</p>	<ul style="list-style-type: none"> ◆ One of 15 other bakeries owned by Mini bakeries 	<ul style="list-style-type: none"> ◆ They do not use cassava starch 	<ul style="list-style-type: none"> ◆ They purchase wheat from millers and they use it directly without additives ◆ They produce about 20,000 loaves of bread /day ◆ They purchase wheat flour at 2950 Kenya shillings per 90Kg bag 	<ul style="list-style-type: none"> ◆ They would be interested in trying composite flours using cassava 	<p>Try experimenting with composite flours</p>

Marketing opportunities for cassava based products

<p>Packaging Manufacturers (1976) Ltd P.O. Box 98541, Mombasa, Kenya Tel: 005-11-434152/3/4 Fax: 005-2-433234 E-mail: packmft@swiftmombasa.co.ke Contact person Ketan M. Shah</p>	<ul style="list-style-type: none"> Manufacturers of high and low density polyethylene and polypropylene bags, sheetings, tubings, and corrugated boxes Started in 1976 It's the major cardboard manufacturer in Mombasa 	<ul style="list-style-type: none"> Uses cassava starch from Tapioca equivalent to about 1 tonne per month Starch is obtained at a cost of 40 Kenya shillings per kg Also uses 1 tonne of SBA from Tapioca at a cost of 60 Kenya shillings per kg All costs include factory delivery 	<ul style="list-style-type: none"> Supply of raw material is not consistent and at times delays The firm also has to pay in advance 	<ul style="list-style-type: none"> Firm would like to see competition in the production of cassava starch as a way of eliminating supply constraints 	<ul style="list-style-type: none"> Explore opportunities for using cassava flour and hence supply a sample of cassava flour If successful explore opportunities for farmers supplying this directly to the company
<p>Packwell Industries Ltd. P.O.Box 46826 Nairobi. Tel: 02-630322 Fax: 02-630321. Contact: Mr. Hemendra Patel/Mr. Dias</p>	<ul style="list-style-type: none"> Makers of corrugated cartons Starch is used as an adhesive/binder 	<ul style="list-style-type: none"> They have used cassava starch from Tapioca Ltd They can use cassava starch if continuous supply is guaranteed 	<ul style="list-style-type: none"> They purchase corn starch from CPC at Kshs. 35/kg They require about 2-3 MT/month of corn starch 	<ul style="list-style-type: none"> They will use cassava starch if supply is reliable 	<ul style="list-style-type: none"> They require information on suppliers Company can use 100% cassava starch
<p>Pan Africa Paper Mills EA Ltd. P.O.Box 535 Webuye,</p>	<p>The factory produces 48,000 tonnes of Kraft</p>		<p>800 tonnes of maize starch is utilised per year at a cost of</p>		<p>Cassava starch could be used instead of starch as long as it is readily available and if it</p>

Marketing opportunities for cassava based products

<p>Bungoma Mr. Gatimbu Production Manager</p>	<p>paper and 40,000 tonnes of paper per year Starch is used in the process of sizing</p>		<p>Ksh.43 and it is purchased from CPC.</p>		<p>could be much cheaper.</p>
<p>Premier Cookies Ltd. Baba Dogo Rd. Nairobi Mr Patel Production Manager Tel: 802965/6 Fax: 802039 pfil@net2000ke.com Visited by; Jagwe, Githaiti</p>	<p>This is a sister company to Premier mills, one of the largest milling companies in Kenya It was established in 1974</p>	<p>Cassava starch was once used and it was discovered that a 10% substitution was acceptable. Beyond that, the shelf life was adversely affected.</p>	<p>About 2,000 tonnes of wheat flour is used per year and this wheat is mainly imported from Australia as grain. Wheat flour costs Ksh.30-33 per Kg (factory del)</p>	<p>2 Kg of cassava starch could be availed as sample for trials</p>	<p>When soft wheat is used, there would be no need to use starch. Starch is used in biscuit manufacture when hard wheat is an ingredient in order to counter the adverse effects of gluten.</p>
<p>Premier Flour Mills Ltd. P.O.Box 59307 Nairobi. Tel: 350113 Contact: Mr. Patel/Mr. Prabhaka</p>	<ul style="list-style-type: none"> ◆ Main business is wheat flour milling 	<ul style="list-style-type: none"> ◆ They do not use cassava ◆ They produce 100-200 MT/Month ◆ They do not use starch 	<ul style="list-style-type: none"> ◆ They produce bakers flour, biscuit flour and home baking flour 	<ul style="list-style-type: none"> ◆ Interested in trying cassava flour for baking 	<ul style="list-style-type: none"> ◆ Try using starch to dilute the gluten/reduce wheat strength ◆ There is potential use of cassava flour and cassava starch when they is guaranteed shelve life of products

Marketing opportunities for cassava based products

<p>Press Masters Ltd. P.O.Box 17560 Nairobi. Tel; 02-823044 Contact: Mr. Ochieng</p>	<ul style="list-style-type: none"> ◆ Produce corrugated cartons among other products 	<ul style="list-style-type: none"> ◆ They have used cassava starch previously 	<ul style="list-style-type: none"> ◆ They use about 2-3 MT of corn starch per month ◆ They purchase locally from CPC ◆ Price is kshs.36/kg 	<ul style="list-style-type: none"> ◆ They can use cassava starch to replace corn starch 	<ul style="list-style-type: none"> ◆ Establish the possibility of a constant supply of cassava starch ◆ Availability and quality of cassava starch are the main problems currently
<p>Prime Cartons Ltd.</p> <p>Visited by; Jagwe, Githaiti</p>	<p>Began in 1996 They manufacture corrugated boxes.</p>	<p>Once used cassava and it was acceptable.</p>	<p>They are using 12 tonnes of maize starch per year bought from Orbit Chemicals Mombasa at a cost of Ksh. 33 per Kg.</p>	<p>A 50 Kg cassava starch sample could be availed to them for trials</p>	<p>The business is steadily growing.</p>
<p>Raiplywood Kenya Ltd. Uganda Highway Eldoret</p> <p>Mr Bainito Technical manager (Adhesives) Tel: 0321 33811-5</p> <p>Visited by; Jagwe, Githaiti</p>	<p>The main products are plywood and block boards</p> <p>The factory uses 7.2 tonnes of Urea formaldehyde glue per year, 60 Kg of tyros</p> <p>Occasionally dextrin is used as a filler.</p> <p>Wheat flour is used as an extender and a thickener. The starch and gluten in</p>	<p>none</p>	<p>1,100 tonnes of wheat flour are utilised per year at a cost of Ksh 18 per Kg.</p>		<p>High quality cassava could substitute wheat flour up to 100%</p>

Marketing opportunities for cassava based products

	wheat help in extending the glue to the entire surface of the wood.				
<p>Ray Pharmaceuticals Ltd. P.O.Box 22830, Nairobi. Tel: 02-536230. Fax: 02-540361. Contact: Dhirendra Shah</p>	<ul style="list-style-type: none"> ◆ They specialise in pharmaceutical products producing tablets, capsules and syrups. 	<ul style="list-style-type: none"> ◆ They have not used cassava starch 	<ul style="list-style-type: none"> ◆ They use corn starch pharmaceutical grade as a carrier in tablets ◆ Consume about 20MT/Annum ◆ They also use dextrose monohydrate and liquid glucose 	<ul style="list-style-type: none"> ◆ They will not mind using cassava starch of BSP/USP grade 	<ul style="list-style-type: none"> ◆ Experiment with cassava starch ◆ Quality is critical

Marketing opportunities for cassava based products

<p>RIVATEX Rift Valley Textiles Ltd. Kapsabet Rd.</p> <p>Mr Alex Kishuru Sales Manager</p> <p>Visited by; Jagwe, Githaiti</p>	<p>The factory is under receivership and has not been in production for the last 3 years</p> <p>It used to deal with textiles 100% cotton and cotton garments.</p> <p>It had a capacity of producing 5 million meters of cloth per month.</p> <p>At 20% scale of operation, 60 tonnes of maize starch would be utilised per year for the process of sizing.</p>	<p>none</p>	<p>Not in production at the moment</p>		<p>It is alleged that cheap imports, smuggling and gross mismanagement have been the main causes for the collapsing of the textile industry in Kenya.</p>
<p>Smithkline Beecham Likoni Rd. Ind. area Nairobi</p> <p>Eng. Nyambok Tel: 534241</p> <p>Visited by; Jagwe, Githaiti</p>	<p>Manufacture tablets and injections</p> <p>Stop purchasing starch in 1998 due to a change of product range</p>	<p>none</p>	<p>Starch is bought in granules form that are purchased through buying centres in Europe</p>		<p>No prospects for using cassava starch since production of medical grade starch requires very high investment.</p>
<p>SunFlag Textiles Ltd. Kampala Rd. Ind. Area</p>	<p>It is one of the largest textile</p>	<p>Cassava starch was once used in the</p>	<p>The factory utilises about 50 tonnes of</p>	<p>A sample of cassava starch could be</p>	

Marketing opportunities for cassava based products

<p>Nairobi</p> <p>Mr Sadya & Mr Ashok Plant Manager</p> <p>Tel: 559721 Fax: 559015</p> <p>Visited by; Jagwe, Githaiti</p>	<p>manufacturers in Kenya</p> <p>Products include knitwear, fabrics and textiles</p>	<p>process of sizing but it requires a temperature of 90°C to gelatinise as compared to maize starch that requires 68°C The higher the temp the greater the energy cost.</p>	<p>maize starch per annum and it is purchased from CPC</p>	<p>availed to their laboratory for further tests</p>	
<p>Tapioca Limited P.O. Box 84059 Mombasa, Kenya Tel: 005-11-221849,226538,226578,228302, 222825 Fax: 005-11-222645,473033 E-mail: tapioca@africaonline.co.ke Contact person Rajese Khagram</p>	<p>It's the major cassava starch producer in the country</p>	<p>Buys fresh roots from neighbouring areas for starch processing</p>	<p>The costs of production are very high especially for utilities such as water</p>		
<p>Triclover Ltd. P.O.Box 17663, Nairobi Tel: 02-54173. Fax: 02-540530. Contact: Mr. Aviv Mavu</p>	<ul style="list-style-type: none"> ◆ Produce cooking aids such as baking powder and starch 	<ul style="list-style-type: none"> ◆ They have not used cassava starch 	<ul style="list-style-type: none"> ◆ They use corn starch as filler in their products ◆ They pack corn starch for sale ◆ They use 15-20 MT/Annum 	<ul style="list-style-type: none"> ◆ They need information on possible use of cassava starch 	<ul style="list-style-type: none"> ◆ To try using cassava starch in their products ◆ They are not aware of any shortcomings in the application of cassava starch

Marketing opportunities for cassava based products

<p>Tropical Sunshine Ltd. P.O. Box Tel: 0151-54392 Contact: Mr. Talib</p>	<ul style="list-style-type: none"> ◆ Produce juices and sauces 	<ul style="list-style-type: none"> ◆ They do not use cassava starch 	<ul style="list-style-type: none"> ◆ They use corn starch from CPC at a cost of Ksh 33/Kg ◆ Starch consumption is 2-3 MT/Month ◆ They use starch as thickener for sauce 	<ul style="list-style-type: none"> ◆ Potential users of cassava starch in all their products ◆ Their market is growing 	<ul style="list-style-type: none"> ◆ Experiment with cassava starch ◆ Concern over cost and availability
<p>Trufoods Ltd. P.O.Box Tel: 557700. Contact: Dr. Shah; Mr. Singh; M. Njiru</p>	<ul style="list-style-type: none"> ◆ Well established in fruit juices, jams, sauces ◆ Exports to Arab countries ◆ Major local market 	<ul style="list-style-type: none"> ◆ Does not use cassava products ◆ Have not tried cassava starch 	<ul style="list-style-type: none"> ◆ Uses 3 ton/month corn starch in custard ◆ Uses 300kg/month modified starch in sauces ketchup ◆ Uses 10ton/month liquid glucose representing 25% max. of total sugar ◆ CPC supplies starch and glucose syrup ◆ Cost of starch 33/=Kg 	<ul style="list-style-type: none"> ◆ Interested to try cassava products ◆ Concern is flow properties ◆ Concern for cost ◆ Concern for shelflife ◆ Concern for availability 	<ul style="list-style-type: none"> ◆ Looking for further information for application of cassava products ◆ Cost is major concern. Cassava products could replace all corn products if quality is guaranteed.

Marketing opportunities for cassava based products

<p>Unga Feeds Limited Dakar Road, Nairobi P.O. Box 41788 Tel: 005-2-541831/2 Fax: 005-2-541676/543688 E-mail: jmbugua@unga.com Contact person James Mbugua, Production Manager</p>	<ul style="list-style-type: none"> • Manufacturer of animal feeds • Mainly poultry feeds • It's the biggest in the country • Subsidiary of Unga group of companies 	<ul style="list-style-type: none"> • Has not used cassava products in feed making • Firm doubts whether cassava is an effective source of raw material 	<ul style="list-style-type: none"> • Currently using maize • Thinks entire industry uses about 20,000 tonnes of maize per annum • Maize is procured at a cost of 16 to 17 Kenya Shillings per kg 	<ul style="list-style-type: none"> • Firm is of the opinion that for cassava to work, supply constraints have to be addressed • It is interested in information regarding the use of cassava in animal feed 	<p>Provide data on use of cassava in animal feed</p>
<p>Unga Limited Ngano house Commercial Street, Industrial Area P.O. Box 30386, Nairobi, Kenya Tel: 005-2-532471/2 Fax: 005-2-545448 E-mail: fmutwiri@unga.com Contact person Mrs. Faith Mutwiri Quality Assurance Manager</p>	<ul style="list-style-type: none"> • It's one of the biggest millers in the country • Processes a number of foods including maize flour, wheat flour • Maize flour is the main product • Has plans to produce composite flours or produces 	<ul style="list-style-type: none"> • Wants to include cassava flour as one of the products. 	<ul style="list-style-type: none"> • Wheat grain is imported while the maize grain is procured locally • Competition is stiff and the factory has undergone a major rehabilitation phase to try and reduce the costs of production 	<ul style="list-style-type: none"> • Would like to get information on use of cassava flour in bread • Firm believes once cassava bread is acceptable to the market then cassava composite flour can be promoted 	<p>Provide recipe for bread using cassava flour</p>
<p>Unilever Kenya Limited. P.O. Box 30062 Nairobi Kenya Tel: 005-2-532505 Facsimile 005-2-543912 E-mail: peter.karatu@unilever.com Or joyce.gathigi@unilever.com Or sarah.hikonyo@unilever.com Contact persons: Peter Karatu Technical Development Manager; Joyce Gathigi, Foods Development Manager , Sarah Hikonyo and Isaac Njoroge</p>	<ul style="list-style-type: none"> • It's the leading manufacturing concern in Kenya producing several household consumer goods • It enjoys an export market in the region with Uganda being a major consumer 	<ul style="list-style-type: none"> • At the moment it is not using cassava products • However it is seeking for a supplier of about 350 tonnes of cassava starch for use in its soap and detergent section • It failed to secure cassava starch locally 	<ul style="list-style-type: none"> • Currently using corn starch in producing Mchuzi mix • Starch is used as a thickener in this product • It uses about 1000 tonnes of corn starch in Mchuzi mix alone • Starch is at the moment being used in Mchuzi mix alone • Corn starch is procured at a cost of 35 Kenya shillings per kg, factory delivered • Corn starch is obtained locally from CPC in Eldoret 	<ul style="list-style-type: none"> • The company is interested in information on the properties of cassava starch compared with maize starch • It is further looking for a credible supplier of cassava starch in the near future (by the end of June) • It is willing to try cassava starch in its products but is only concerned about future availability of reliable supplies and at consistent quality 	<ul style="list-style-type: none"> • Immediately contacts of world cassava starch producers should be availed • Provide all the technical information on cassava starch properties • This is a big company that is looking for cheaper alternatives that can work. • There is already an opportunity as the company is looking for cassava starch

A summary of the potential Cassava starch market by the above companies is given on Table 3 b below. The companies supervised utilise over 100 MT of starch. The first three consumption accounts for 83% of the starch utilised by the above companies. This is equivalent to only 0.8 % of the country's starch consumption. It is then evident that promotion of cassava starch production in Kenya is a feasible venture.

Starch is utilised in the pharmaceutical industry but if cassava starch is to venture into this market then medical grade starch must be produced. Another venture worth exploring is the use of cassava in composite flours. Cassava flour should be produced and used in optimal ration for the bakery industry.

Table 1b. Summary of the potential Cassava starch market.

FIRM	QUANTITY (TONNES/Y EAR)	COST (35 PER KG)
PACKWELL INDUSTRIES NRB	36000	1260000000
PRESS MASTERS NRB	36000	1296000000
CONTINENTAL PRODUCTS LTD	24000	840000000
KENYA BREWERIES LTD	10000	35000000
CASTLE BREWERIES	4000	140000
UNILIVER KENYA LTD.	1500	52500000
RAIPLYWOOD ³		
UNGA NRB ¹		
PAN AFRICA PAPER	800	34400000
DAIS BAKERY LTD MSA ¹		
CARTON MANUFACTURES LTD.	250	11250000
PREIMIER FLOUR MILLS ¹ NRB		
CHANDRIA INDUSTRIES LIMITED	100	3500000
SUNFLAG TEXTILES	50	1750000
TRUFOODS	39.6	1386000
TROPICAL SUNSHINE THIKA	36	1188000
E.A.PACKAGING NRB	420	1225000
KENYA ORCHARDS NRB	30	990000
RAY PHARMACEUTICALS	20	700000
TRICLOVER LTD	20	700000
PRIME CARTONS	12	396000
JAMBO BISCUITS	12	540000
HENKEL E.A	12	420000
JETLACK FOODS	12	432000

Marketing opportunities for cassava based products

CARLTON PRODUCTS NRB	12	396000
PACKAGING MANUFACTURERS	12	480000
CENTRO FOOD LTD	10	350000
KENYA COLD STORAGE NRB	10	350000
BEST FOODS LTD NRB	6	210000
MILLY FRUIT PROCESSORS LTD MSA	1.2	42000
CARTUBOX	1	39000
RIVATEX ²	0	0
KENBLEST ³	0	0
SMITHKLINE BEECHAM*	0	0
GOSHWAMI PRINTERS	0	0
ATTA (KENYA) LTD MSA	0	0
HOUSE OF MANJI ¹		
UNGA FEEDS LTD NRB ¹		
GOLDEN BISCUITS ¹		
KENAFRIC BAKERS ¹		
MINI BAKERS NRB ¹		
PREMIER COOKIES ¹		
Total cassava starch potential	115600.8	3764694000

Key:

*Utilises medical grade Starch.

¹ Produce flours and hence possible market for cassava based composite flours

² No longer in production.

³ Using wheat flour as starch substitute

7.2. OVERVIEW OF THE KENYAN STARCH MARKET.

The total market demand for starch is currently estimated at about 12,000 MT. The partitioning of the starch produced is given in Table 4 below. Other cassava products include glucose and dextrose. The current utilisation of these products in the industry is given in Table 5 below. This is lower than the demand in the past. The downward trend is mainly explained by the collapse of the textile industry and competition from cheaper imports from the COMESA region.

Table 4. Partitioning of starch to various industries

Sector	1997(MT)	1998(MT)	2000(MT)	Market share(%)
Paperboard	1611.5	1,185.4	1,800	
Paper				
Textile				
Pharmaceutical				
Food processing				
Plywood				

Table 5. STARCH, GLUCOSE AND DEXTROSE UTILISATION

PRODUCT	1997 (MT)	1998 (MT)
Corrugator starch	1611.450	1185.400
Paper starch	1028.800	808.100
Textile starch	388.000	205.000
H/M pharmaceutical maize starch	0.000	12.500
Corn starch snowflake 3400	0.000	3.550
L/M pharmaceutical maize starch	0.100	0.000
Food grade H/M maize starch	466.725	559.650
Brewers maize starch	7378.900	7761.105
Food grade L/M maize starch	775.150	952.500
Bakers maize starch	796.850	923.450
Modified starch	5.850	55.608
43 BE/42 DE glucose syrup	5185.628	4529.446
43 BE/63 DE glucose syrup	36.492	29.989
45 BE/42 DE glucose syrup	1009.464	320.549
Amijel starch	0.500	0.550
White maize dextrin	6.000	9.700
Yellow maize dextrin	27.250	0.800
Waxy maize dextrin	0.150	34.750
Dextrose monohydrate	586.650	365.250

Most of the starch is native and is derived from corn. However, the plywood sector uses wheat starch. Concerns here were mostly about price. Wheat starch was obtained at a much lower price than corn- starch.

Local production accounted for most of the cornstarch that was used. On the other hand most of the of the cassava starch is at the moment being imported as local production costs are found to be higher. The resultant high price of the local cassava starch makes it difficult for it to compete in the market.

Starch based adhesives were also used by the packaging industry and one of the firms reported using about 1 tonne per month.

7.2.1 Paperboard

This sector comprises 3 major firms and a number of other smaller factories. These accounted for over 50% of the starch requirements. Most of the firms including all the 3 major ones are located in Nairobi.

This sector reported using cassava starch before although currently all the starch was corn-based and was produced locally. Use of cassava starch was discontinued due to inconsistency in both supply and quality

The market demand for starch in the packaging sector was estimated at about 1800 tonnes per year.

The price ranged from 39 to 45 Kenya Shillings per kg delivered to the factory.

7.2.2 Paper

Paper production in Kenya is the second major channel of starch utilisation. This industry consumes over 800 MT with most of it being consumed by Pan Africa Paper Ltd in Webuye. The starch utilised in paper production mainly goes into the production of Kraft paper, which is mainly used for packaging.

7.2.3 Textile

The textile industry in this country has virtually collapsed with the introduction of liberalisation, The once vibrant industry has had many of its factories which depended on cotton as an input shut down. Some of the factories were private while others were parastals. This resulted in loss of jobs and reduced the overall demand of starch in the country. Those still operational produce synthetic materials e.g. Polyesters, Nylon, etc., and do not use starch.

However, with the new development i.e. African Growth Opportunity Act (AGOA). There are signs that cotton farming will be encouraged and textile revived. Now that textile business with USA market seems to be doing extremely well with the market share given to the developing

world has been increased from 1.5 to 3.5 percent there is need for cassava starch to find a niche in this market.

7.2.4 Pharmaceutical

Cassava starch is not utilised in the pharmaceutical industry mainly because medical grade starch is required. All of the starch used in this industry is imported. It is important that cassava starch is processed to meet the required medical grade starch requirements if it is to venture into this market.

7.2.5 Food Processing

Starch is used in various food products it performs various functions including Sweetening, as a flour, binding e.t.c.

☒ Composite Flours

Cassava flour should be incorporated in other widely used flours so that it can be used in two of the large food industry inputs Bread and Biscuit production.

❖ *Biscuits*

There are 3 major factories producing biscuits in the country. All of these are located in Nairobi. This food sub-sector utilises about 40,000 MT of wheat flour per annum.

The cost of wheat flour for biscuits ranged from 29 to 30 Kenya shillings per kg

In the past there were shortages of wheat flour, notably around 1990 and there was an attempt then by some factories to substitute wheat flour with locally produced cassava flour.

However biscuits made from cassava flour were found to have a shorter shelf life. Beyond six months the biscuits changed colour.

Also the fibre content was found to be high which affected the texture of the flour.

Other problems associated with use of cassava flour included lack of commercial quantities, quality and low protein content

❖ *Bakery*

This sector comprises numerous firms enjoying small portions of the market. Not all of the bakeries could be visited. Competition was found to be stiff and all of the firms were interested in efficient methods of production so as to bring down the cost per unit of output.

None of the bakeries was found to be using cassava flour at the moment. The industry was very sceptical that cassava flour could produce quality product.

☒ General

Most of the manufacturers that had used cassava flour stopped because of quality inconsistency. There is hence need to maintain quality of the cassava if cassava starch is to compete for a profitable market share. Thus hazard analysis of critical control points (HACCP) should be carried out to provide quality assurance of the cassava. The market demands that cassava starch for use in the paperboard industry meets the following criteria:

Moisture content	-11.5% to 12.5%
Appearance	- white
Starch content	- 87% to 88%
Ash	- 0.25% to 0.35%
Protein	- 0.5% to 0.7%
pH	- 4 to 5
Shelf life	- 12 months
Packaging	- 50 Kgs

In addition, it was found necessary to promote awareness of cassava utilization as flour and in animal feeds. Information on the use of cassava flour in production of bread, cookies, biscuits and other baked products should be publicized in the country. This information should include recipes of some products. Cassava has been used for production of feeds includes pig feed (Oke, 1990). The information on the processing steps and ratios of the cassava meal added to the feed should also be publicized.

Although the textile industry in Kenya has seen better days it is important to capture the little market available. The limitation of cassava starch utilization in this industry is its high gelatinization temperature (90 °C) as opposed to that of maize (68 °C). High gelatinization temperatures translate to high cost of production. Modifying the starch will eliminate this limitation. Modifying cassava starch and ensuring quality consistency will ensure that it has an advantage over maize starch in the brewing industry.

7.2.6 Plywood and paperboard

This is a sector where cassava based raw materials have a chance of being used in the short-run. The combined raw material demand for this sector is over 2000 MT per year. Cassava has already been used as a raw material in this sector and some industries expressed preference for its starch over cornstarch. The rural producers can also easily meet quality specifications for this sector, as standards are relatively lower.

Issues

Factors that industry is concerned about include the following:

- Quality consistency
- Timeliness of supplies
- Availability of supplies
- Competitiveness of price

Recommendations

It is therefore important that production and supply studies be carried out to identify the likely constraints that may hinder supplies of commercial quantities to this sector

Samples of the high quality cassava flour should also be availed to the industries for testing under different technological conditions and where positive results are obtained supply schedules should be looked into to plan for them well before hand.

More information needs to be provided to all of the other firms within this industry and to enable them explore the potential for cassava.

7.2.7 Utilisation in feeds

A factor restricting the development of animal production in many developing countries is the cost of imported feed, which has often gone up several fold because of local currency with respect to world markets. If part of the feed could be substituted with root crops such as the cassava then part of the feed could be freed for human nutrition.

The low protein, fiber and high content of soluble carbohydrates are notable features of the cassava root. Cassava tops, stems and leaves are also available as animal feed and are comparatively high in utilizable protein.

The International Development Research Centre in Canada has recommended that cassava could be a substitute of up to 40 percent for maize in the nutritionally balanced rations of pigs without any deleterious effects, and up to 30 percent in poultry rations. It has also been reported that when cassava was substituted for maize in a poultry broiler ration at levels of up to 30 percent, there was no significant difference in the performance at all levels, but the 20 percent level of substitution was the most economical (Gomez *et al.*, 1984). It required 215 kg of feed to

produce 100 kg live weight with a 20 percent substitution. High levels of cassava intake are more acceptable for broiler than for layers. In the economic assessment of the rations, the least cost broiler diets containing 20 percent cassava meal gave the least returns while profitability increased with the level of cassava meal in the case of pig trials.

In pig feed the performance was progressively better as the level of cassava in feed was increased. It required 339 kg of feed to produce 100 kg weight with corn alone, where as it required 337 kg and 331 kg respectively with 20 percent and 30 percent cassava substitution.

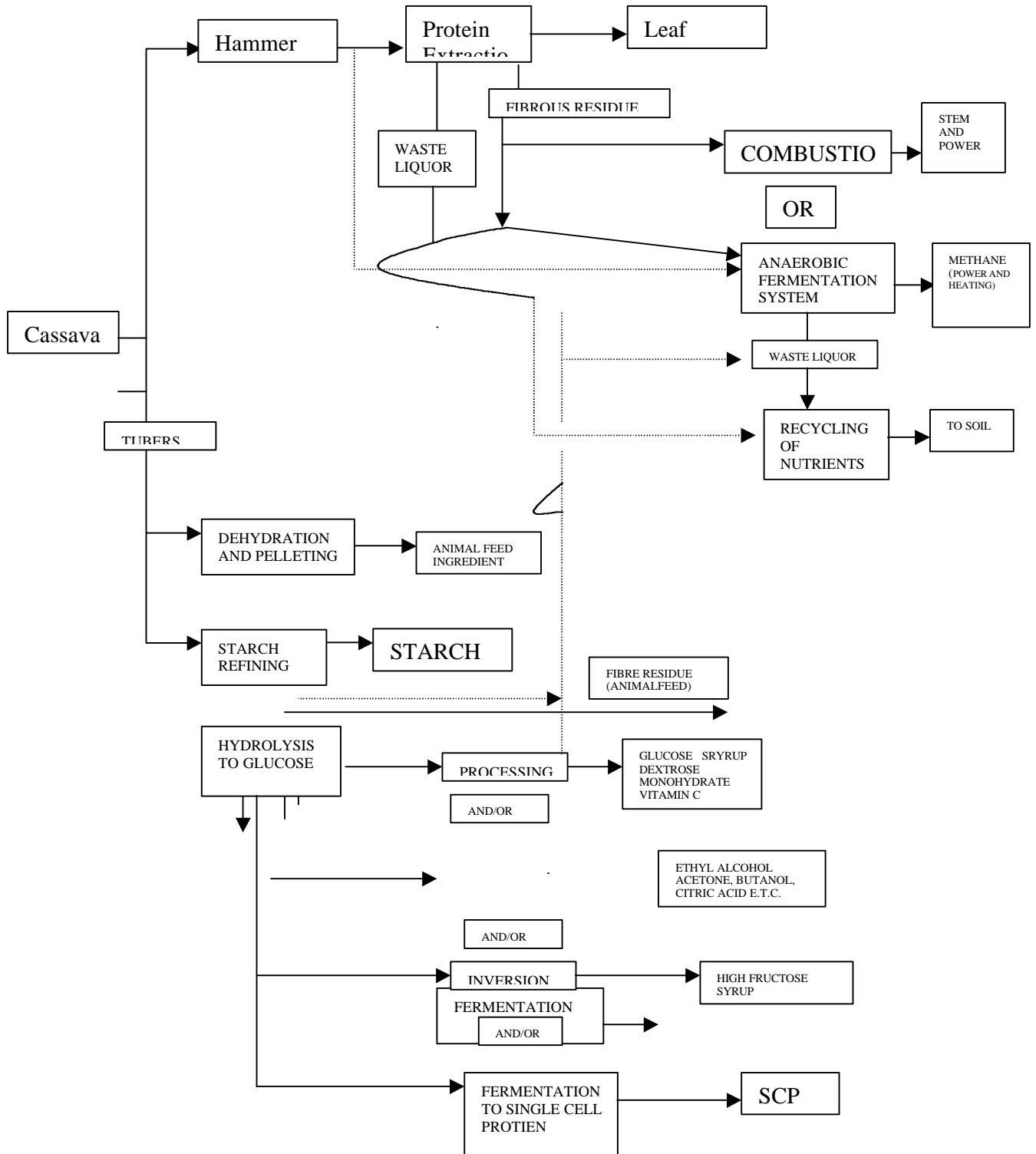
Cassava may also be used as a substitute for maize in cattle feed. Cassava has been used as the main source of energy in dairy feeds, resulting in higher milk and fat yields and live weight gains (Pineda &Rubio, 1972). Similar results have been obtained for beef cattle and cassava-based diets gained significantly faster than those fed bran or corn and corn – based diets.

On average about 246 000 MT of animal feeds are produced per year of this maize constitutes about 10 percent. Given that cassava can be substituted for Maize at the rate of 20% than over 4900MT of Cassava can be utilized in animal feeds in Kenya per year. In addition, the ministry of agriculture has reported that between 1993 and 1998 over 6.9 million cattle and calves were slaughtered for beef The pigs slaughtered over the same duration amounted to 4.2 million (CBS, 1999). It is evident from the data collected in the survey that cassava is not utilized in the production of animal feed in this country. From the statistics quoted above it is clear that the cassava industry has been loosing on this very important market. It is now time to take action and promote the use of cassava in the animal feed production.

7. 2.8 Other potential uses of the cassava

The products discussed above are those that represent the felt need of the market as it is now. In no way do these products do these products exemplify the potential of the cassava. One needs to have only needs look at the agro-industrial system for cassava given in Figure 3 below to understand that many other products could be produced from this priceless resource.

Figure 3. An Agro-Industrial System for Cassava



SOURCE: Mc Cann, 1976

8.0 Conclusions

Cassava is widely used in Kenya by almost all communities, but has limited uses in terms of the products manufactured from it. Starch has potential for application in the food industrial subsector. The demand according to this study stands at over 100000 MT per annum. The food subsector takes only about 13% of the total. There is need for development of starch production to meet the demand. The only starch manufacturer produces erratically and at high costs. The flour is finding more acceptance in compositing with cereal flours for different local food preparations. There is also potential use of cassava flour in plywood manufacture. Industrialists have yet to fully utilize cassava in animal feed manufacture. The challenge in the utilization of cassava starch and flour lies in; convincing the end user of the safety of the products and possible use in diversified products, demonstrating high quality products from cassava. This calls for efficient information flow from the researchers to the manufacturers in terms of potential utilization areas, quality improvement and the assurance of sustainable supply.

9.0 References

- CBS, 1998. Kenya Demographic and Health Survey 1998. National Council for Population and Development Central Bureau of Statistics. Macro International Inc. Calverton, Maryland USA. 1999.
- CBS, 1999. Republic of Kenya Statistical Abstract. Ministry of Finance and Planning. Government Printing Press 1999- Nairobi.
- FAO, 1990. Roots, Tubers, Plantains and Bananas in human nutrition. FAO, Rome, Italy.
- Goering, T.J. 1979. Tropical root crops and rural development. World Bank Staff working Paper No. 324. Washington, D.C., World Bank.
- Gomez, G. Santos, J. & Valdivieso, M. 1984. Least- cost rations containing cassava meal for broilers and growing pigs. Symp. Int. Soc. Root crops. 6. Lima, 21-26 Feb. 1983,p.393-400, Lima, International Potato Centre.
- Jaffe, S., 1995. Perishable Profits: Private sector Dairy processing and marketing in Kenya. In: Marketing Africa's High-Value Foods – Comparative Experiences of an emergent private sector. Eds. Jaffe, S and Morton, J. Kendall/ Hunt Publishing Company.

Oke, O. L. 1990. Cassava Meal. In:Non-traditional feed sources for use in swine production. Eds. Thacker, A.P. and Kirkwood, N.R. Butterworth Publishers United States of America.

Pineda, M. J & Rubio, R.R. 1972. Un concepto nuevo en el levante de novillas para ganaderia de lenche. Rev. ICA, (7): 405-413