UNIT 10

Utilization of Cassava and its Products

Cassava is an important food in the tropical areas of Africa, Asia and Latin America. It is estimated that the crop provides about 40% of all calories consumed in Africa.

Cassava has often been considered an inferior food because the tuber is low in protein, essential minerals and vitamins (*see* Table 10.1). However, in many cassava-growing areas its use as food helps to alleviate problems of hunger and carbohydrate intake deficiency and thus its importance in terms of food security in these areas cannot be over-emphasized. In addition, cassava leaves are consumed as a vegetable in many parts of Africa. They constitute a good source of protein and essential nutrients (*see* Table 10.2).

A major drawback in the use of cassava is the cyanogenic glucosides which it contains and which, upon hydrolysis, produce the very toxic cyanide. Residual cyanide in improperly processed cassava foods contributes to the etiology of goiter and spastic paraparesis which are endemic in several African countries.

Cassava cultivars are generally classified into low-cyanide and high-cyanide varieties, according to their cyanogenic glucoside content expressed as cyanide. The leaves generally contain from 5 to 10 times more cyanide than the tubers. The cyanide content can be established only by chemical analysis of the leaf or tuber, and not by any particular morphological or organoleptic characteristic.

Utilization for human consumption

The cassava tuber is utilized in many food preparations in Africa. It provides most of the calories in a meal, while the vegetables,

Table 10.1

Composition of cassava products prepared traditionally in Cameroon*

	Raw peeled tuber	Tuber cooked in water	Bâton	Gari	Cooked gari	Cooked flour		Tuber, cooked and washed (*medua-me-mbong*)	Peeled, cooked and washed
						Steeped without peel	Steeped with peel		
Calories	395	394	399	400	400	400	397	399	395
Proteins (g)	1.51	1.49	0.85	1.25	1.25	0.75-0.87	0.91-1.79	0.83	1.95
Lipids (g)	0.4	0.1	0.1	0.7	0.7	0.2	0.3	0.2	0.3
Total carbohydrates (g)	9.63	96.8	98.1	96.9	96.9	98.2	96.7-97.2	98.6	96.0
Indig. carb. (g)	1.9	1.7	1.7	1.9	1.9	1.5-1.7	1.2-2.0	1.7	10.8
Ash (g)	1.77	1.61	0.98	1.13	1.13	0.74-0.77	1.14-1.27	0.34	1.71
Calcium (mg)	42	42	34	33	33	30-33	35-52	61	389
Phosphorus (mg)	122	110	62	61	61	43-49	49-73	39	45
Ca/P	0.34	0.38	0.55	0.54	0.54	0.61-0.76	0.64-0.71	1.56	8.6
Fe (mg)	2	2	15	5	5	1-3	3-41	1	13
Thiamine (µg)	96	71	46	60	38	28-44	58-80	14	52
Riboflavin (µg)	57	57	95	49	49	36-55	28-98	30	20
Niacin (µg)	1,611	1,450	756	1,128	1,151	574-777	864-1,395	161	17
Ascorbic acid (mg)	61	4	6	6	-	0	0	-	-

Note: * Per 100g dry matter
Source: Favier, J.C. et al. 1971 'La technologie traditionelle du manioc au Cameroun: influence sur la valeur nutritive'

legumes and meat/fish provide the necessary protein, minerals and vitamins. Various types of cassava flour are cooked into thick pastes by adding water to the flour and stirring the mixture rapidly over the fire.

Over the years, cassava-consuming populations have developed various processing methods to detoxify cassava tubers and leaves, including boiling, drying, grating and fermenting. The efficacy of these methods differs considerably. It is highest for processes that

Table 10.2

Composition of cassava leaves and selected other foods in terms of per 100g edible portion, fresh weight

	Reference	Calories	Moisture %	Protein g	Fat g	Total carbo-hydrate g	Fibre g	Ash g
Cassava leaf, raw	a	91	71.7	7.0	1.0	18.3	4.0	2.0
	b	60	81.0	6.9	1.3	9.2	2.1	1.6
Chinese cabbage, raw	b	17	94.2	1.7	0.2	3.1	0.7	0.8
Spinach, raw	b	19	93.0	2.4	0.4	2.8	0.7	1.4
Soybean whole seeds salted, black	b	330	20.1	18.1	9.4	46.3	8.5	6.1
Wheat whole grain, hard	b	332	12.5	11.6	2.2	72.1	2.1	1.6
Maize, yellow	b	349	13.6	9.1	4.2	71.7	2.3	1.4
Rice, unhulled, rough	b	341	13.7	5.8	2.3	73.4	10.4	4.8

	Ca mg	P mg	Fe mg	Vitamin A ß Carotene equivalent µg	Thiamine mg	Riboflavin mg	Niacin mg	Ascorbic acid mg
Cassava leaf, raw	303	119	7.6	11,775	0.25	0.60	2.4	8
	144	68	2.8	8,280	0.16	0.32	1.8	82
Chinese cabbage, raw	102	46	2.6	2,305	0.07	0.13	0.8	53
Spinach, raw	62	39	3.9	3,640	0.06	0.22	0.7	56
Soybean whole seeds salted, black	29	163	1.1	520	0.07	0.27	18.6	-
Wheat whole grain, hard	48	382	3.3	0	0.37	0.12	4.6	0
Maize, yellow	14	245	2.8	270	0.29	0.11	2.1	0
Rice, unhulled, rough	24	236	1.4	-	0.33	0.06	5.6	-

Source: a: Food Composition Table for Use in Africa. Food and Agric. Org. and US Dept. Health, Educ. and Welfare. 1968

b: Food Composition Table for Use in East Asia. Food and Agric. Org. and US Dept. Health. Educ. and Welfare. 1972

achieve tissue disintegration, such as grating, grinding and fermenting. The boiling of cassava leaves, after grinding, has seemed to be efficacious in detoxifying them.

The tubers of high-cyanide varieties and leaves of all varieties should be thoroughly processed in order to reduce the cyanide content to minimal levels. Only low-cyanide varieties are recommended for foods prepared from fresh cassava without grinding or fermenting.

Many traditional cassava-based food preparations of Asia and Latin America may be used alongside traditional African preparations. In addition, in many African countries home economists and nutritionists have developed a number of non-traditional foods by incorporating locally grown cassava into the recipe in place of exotic ingredients.

Some of the most common cassava-based foods in Africa are listed below.

Abacha	Boiled, shredded and dried cassava slices (similar to noodles); eaten in salads (Nigeria)
Ampesi	Boiled cassava tubers; normally eaten with vegetable/meat soups or stews (Ghana)
Agbele kaklo	Deep-fried snack in the shape of croquettes or balls prepared from grated cassava mash; eaten as snacks (Ghana)
Akple	Thick porridge prepared from a mixture of maize and cassava dough; eaten with okra soup or stew (Ghana)
Attieke	Steeped, pounded, fermented cassava tubers which are pressed, crumbled and steamed; eaten with milk or meat and vegetables (Côte d'Ivoire)
Bâton du manioc	Wet cassava paste wrapped in leaves, shaped as a long stick (30 to 60cm) and cooked (Cameroon)
Chickwangue	Like bâton du manioc, but shaped into a ball (Cameroon)
Elubo lafun	Thick paste prepared from traditional cassava flour (lafun); eaten with vegetable/meat soup (Nigeria)

Fufu	Boiled cassava pounded with plantain or with cocoyam; eaten with various soups (Ghana)
Foofoo	Soaked, pounded and fermented mash which is then mixed with water, sieved, and cooked into a thick paste; eaten with stew (Sierra Leone)
Gari (garri)	Grated, fermented, sieved and fried cassava mash; in its final form, it is a free-flowing granular meal; used in a variety of ways in main meals and as a snack (West Africa)
Garifoto	Combination of gari and fish or egg sauce to make a one-dish meal (Ghana)
Kokonte	Dried, unfermented cassava chips, milled into flour and made into a thick paste; eaten with soups (Ghana)
Kourou-kourou	Thin gruel made by adding some fermented cassava flour to boiling water (Cameroon)
Kumkum	Cassava flour prepared from fermented tubers by grating, forming into balls, and drying over the fireplace; the dried balls are stored until required and marketed as balls or flour (Cameroon)
Kpokpo gari	Peeled and soaked tubers which are then grated, washed, dried, roasted into large hard grains and then soaked in water again; eaten with side dishes (Nigeria)
Njambo	Dried, fermented cassava chips, milled into flour and made into a thick paste (Gambia)
Tapioca	Wet or partially dried sieved starch particles heated with continuous stirring, forming gelatinized, dried granules; eaten as breakfast porridge (West Africa)
Ugali	Dried cassava chips produced by sun-drying, or steeped and fermented prior to drying, and then made into a thick paste; eaten with soup (Tanzania)
Yakeyake	Steamed cassava dough (Ghana)

Cassava flour is used in many bakery products, especially bread. Research into the use of cassava flour in bread has shown the process to be a viable technical proposition. Good quality breads have been produced with 10 to 100% of the wheat flour being substituted by cassava flour (*see* Figure 10.1) With regard to cakes and biscuits, 100% cassava flour can be used with good results. There is little information on the storability of these products, but it is known that they can be stored for up to 2 days.

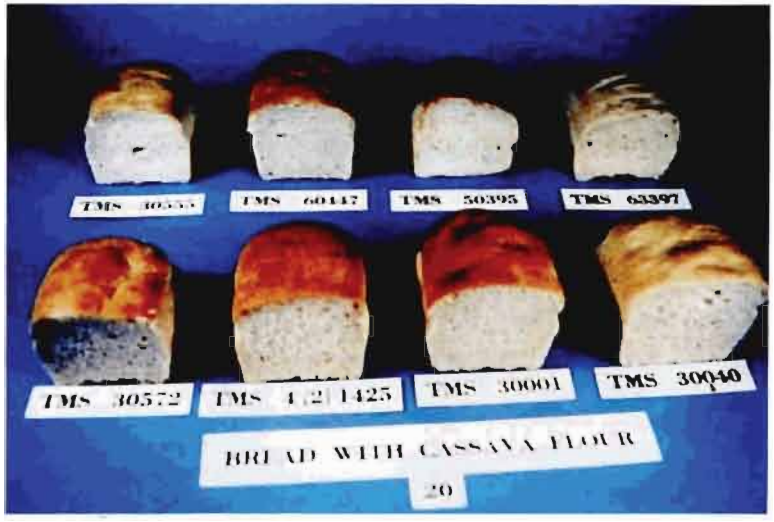

Figure 10.1
Bread with 20% cassava flour made from IITA improved varieties

Utilization for livestock feed

There is considerable potential for using cassava feed rations in local livestock industries (*see* Table 10.3). The production of cereals, especially maize, is not high enough to meet the energy requirements of both human beings and livestock. Since the 1960s, some EEC countries have used cassava chips in compound animal feed because of the high energy content and low price of cassava.

Research carried out by the Institute of Agricultural Research and Training in Nigeria has shown that substituting up to 44% of the maize in pig feed with cassava does not lead to any reduction in the performance of pigs. In fact, with the addition of 0.1 to 0.2% DL methionine, the performance of pigs fed on diets which contain more than 50% cassava meal is improved. It has also been reported that the use of cassava in the diet of white Fulani herds

Table 10.3

Animal feed rations using cassava meal

Cassava meal inclusion rates[1]

Type of feed	Percentage cassava meal (dry) *Cautious*	*maximum*
Broiler starter	5	10
Broiler finisher (4 weeks)	10	20
Chick'starter	5	10
Pullet grower	10	25
Layer	25	40
Sow/boars	10	30
Piglets (to 8 weeks)	5	10
Pigs (8-16 weeks)	10	25
Pigs (16 weeks-maturity)	15	30

Layers mash[2]

Cassava tuber meal	40.8
Cowpea*	20.0
Blood meal	16.8
Bone meal	2.5
Oyster shell	7.8
Salt	0.24
Min/vit mix (Pfizer)	0.24
	100.00

Notes: * Cowpea must be roasted before milling to remove antinutritional factors
Diet is not balanced for sulphoamino acids. Advisable to check acceptability to chickens

Source: [1] Dr Tewe, University of Ibadan, Nigeria; [2] 'Feed International', May/June 1980

in Nigeria has increased milk production by 22%; this has been accompanied by an increase in percentages of butter fat, protein and non-fat solids.

Utilization in industry

Cassava starch is an important industrial raw material. Over100 cassava starch derivatives (chemically modified starch) have been developed to provide products with the physical and/or chemical properties required for specific applications. However, the capital investment needed for the production of starch derivatives is fairly high, and a careful economic analysis must be made before establishing an industry to produce these derivatives.

Raw, unmodified cassava starch can be used successfully, and in many instances advantageously, for industrial applications where, formerly, cheaply produced maize (USA and Canada) or potato (Europe) starches were used.

Cassava starch has wide applications in industry. It is used in the food industry in many preparations, including sauces, gravies, mustard powders, baby foods, tapioca products, glucose production, confectionery and bakery products; it is also used as a jelly or thickening agent. It is used extensively in the manufacture of adhesives, dextrins and pastes and as a filler in the manufacture of paints. In the textile industry, it is used for warp sizing, cloth and felt finishing.

Good quality cassava starch can be produced by cassava growers to meet standard specifications for the local market or export. This has been done in some developing countries, including India, Thailand and Malaysia. The important factors affecting the quality of starch are its color, uniformity of size, moisture content, purity and pH. The most desirable end-product should be a clean, white starch, free from specks, dirt and insect infestation, with a moisture content ranging from 12 to 18%.