
**THE TECHNOLOGY AND FINANCIAL ANALYSIS OF TRADITIONAL
PROCESSING OF CASSAVA INTO FERMENTED CHIPS, GARI AND
AGBELIMA IN THE GA DISTRICT OF THE GREATER ACCRA
REGION OF GHANA
(CSIR-FRI/RE/QW/1997/015)**

Submitted under NARP Project

BY

**W. QUAYE and W.K.A. AMOA-AWUA
Food Research Institute
Accra, GHANA**



THE TECHNOLOGY AND FINANCIAL ANALYSIS OF TRADITIONAL
PROCESSING OF CASSAVA INTO FERMENTED CHIPS, GARI AND AGBELIMA IN
THE GA DISTRICT OF THE GREATER ACCRA REGION OF GHANA

Wilhemina Quaye and W.K.A. Amoa-Awua

Food Research Institute, Council for Scientific and Industrial Research, P.O.Box M.20. Accra.

.....

ABSTRACT

Cassava processing is one of the major rural/informal food industries in Ghana and a survey was conducted to assess the traditional technology and financial viability of the industry in the Ga district. Traditional cassava processing was found to be extensively practised and the technologies used did not differ from those employed in other parts of the country. Traditional processing of cassava into gari was assessed to be not financially viable as the variable cost per unit was higher than the unit selling price of the product. The break even analysis showed a negative gross margin of ₵132.00 on each 'olonka' approximately 1.2 kg of gari processed showing that the product was under priced by the traditional processors. Initial capital outlay for traditional cassava processing into gari was ₵495,000.00 and raw material, labour and fuel accounted for about 50.21%, 39.57% and 5.23% of the total variable cost respectively. Traditional processing of cassava into agbelima was however found to be a viable venture but quantities produced were below the existing processing capacities due to limited consumption and short shelf life of the product. Breakeven analysis showed a positive gross margin of ₵649.00 on each minibag of agbelima at a breakeven quantity of 5.43 minibags. Initial capital outlay for traditional agbelima production was about ₵154,000.00 and the raw material and labour cost constituted about 54.96% and 26.15% of total variable cost respectively.

INTRODUCTION

Cassava (*Manihot esculenta* Crantz) is currently the most widely cultivated root crop in Ghana with a total annual production of about 6.025 million metric tonnes, contributing 22% of the Agricultural Gross Domestic Product, 19% of dietary energy intake and averaging 380 kcal/day per person (Ministry of Agriculture, Ghana 1992, 1994). It is grown in almost all the regions in Ghana with the greatest production areas in Brong Ahafo and Eastern regions. (See Appendix 1). The importance of cassava is due to its durability as a plant and also due to it being a cheap and excellent source of dietary carbohydrate. The high yielding drought-tolerant cassava often referred to as an excellent famine reserve crop, is undemanding as a crop and able to grow under a variety of climatic and soil conditions including low fertility and high acidity and has a high return of food per unit of energy input (Cooke and Coursey 1981; Cock 1985; Kwatia 1986; De Bruijn and Fresco 1989).

Despite the numerous advantages of cassava as a crop, its utilization as food is limited by the high perishability of cassava tubers with a natural storage life of only about 2-3 days after uprooting, their low protein content of 1 to 3% and the presence of the cyanogenic glucosides, linamarin and lotaustralin which impart toxicity to the tuber (Nartey, 1968; Cooke and Coursey 1981; Rickard 1985). Fortunately these factors which limit utilization of cassava as food can be overcome by processing (Hahn, 1989; Oyewole and Aibor, 1992) and cassava is traditionally processed into various products such as gari, agbelima and kokonte in Ghana. The traditional processing involves combinations of different unit processes including grating, dehydration, fermentation and roasting which convert the perishable fresh roots into shelf stable products and constitutes one of the major rural/informal food industries in Ghana serving as a means of livelihood for a number of rural women who rely on family labour and engage in the activity as a household enterprise (Amoa-Awua 1996). Agbelima and gari production for example are important economic activities for the livelihood of most women in cassava growing

areas and the women processors also create job opportunities for other women who assist in terms of labour, and also provide market for cassava at the village level. The processing of cassava into sundried fermented cassava chips is also extensively practised in certain parts of Ghana and currently there is a drive towards exportation of cassava chips to overseas markets.

Lartey (1975) identified a number of problems encountered during the traditional processing of cassava including uneconomic operations, high labour input, low efficiency, time consuming nature of the processes, rudimentary packaging of products, lack of suitable machines for processing and for quality control and the very small scale nature of operation. According to Sefa-Dedeh (1993) the technologies employed for the traditional processing may be at a rudimentary stage using simple techniques and implements and have strong links with the rural traditional environment.

In recent years there has been a drive towards upgrading and mechanizing cassava processing in Ghana and this has brought to the fore the issue of financial viability or otherwise of industrially organized processing of cassava. Preliminary investigations by the current authors indicate that the financial viability of medium scale industrially organized mechanized processing of cassava is undermined by the unintentional undercosting of the competitive traditional cassava products such as fermented cassava chips and gari by traditional processors and that the viability may vary from locality to locality depending on prevailing conditions such as scale of cassava production and season.

In the present study the traditional methods and the financial viability of the traditional processing of cassava into fermented cassava chips, agbelima and gari in the Nsawam District of the Eastern Region of Ghana is investigated. The financial viability of mechanized cassava processing in the district is the subject of another study by the authors.

MATERIALS AND METHODS

METHODOLOGY

Survey

A formal survey was carried out in the Ga Rural District of the Greater Accra Region to assess the socio-economic background of traditional cassava processors in the district, the source of cassava used for processing, the technology employed and the problems encountered during the traditional processing and the cost and revenue generated by the processing activities (Appendix 2).

Data was gathered for analysis using a structured questionnaire and secondary data on cassava production obtained from the Ministry of Agriculture. Twelve agbelima producers, and 12 gari producers were randomly selected from nine villages and interviewed. 12 producers of fermented cassava chips, kokonte, were also to be interviewed but non were found in the villages selected. The villages covered in the survey were Amasaman, Ayimensah, Danfa, Opah, Onyanben and Oyarifa, Kweiman, Kutunse and Temun.

Analysis of Data

Break even analysis was carried out on data gathered on both gari and agbelima production to determine the financial viability of traditional processing of cassava into agbelima and gari in the Ga district.

RESULTS AND DISCUSSION

BIODATA OF RESPONDENTS

Educational Level

Of the twenty-four women processors interviewed, only 20.83% are educated to the basic school level. The rest are illiterates. Thus, there is the need for women to be properly educated to be more productive. If rural women are educated, they would appreciate better issues relating to their economic empowerment and the rate of improved technology adoption will be greatly enhanced.

Age Distribution

The ages of the processors interviewed range between 21 to 50 years, with the average age of 39 years. Table 1 below shows the age distribution of the respondents.

TABLE 1. THE AGE DISTRIBUTION OF RESPONDENTS

AGE GROUP	NO. REPORTING	PERCENTAGE
20 - 30 yrs	6	25.00
31 - 40 yrs	8	33.33
41 - 50 yrs	7	29.17
51 - 60 yrs	3	12.50
TOTAL	24	100.00

As summarized in Table 1, of the total sample interviewed, 33.33%, 29.17% and 25% represented respondents between 31 - 40 years, 41 - 50 years and 21 to 30 years of age

respectively. Only 12.5% represented those between 51 to 60 years of age.

Occupational and Marital Status

In addition to cassava processing all the women are engaged in farming with their husbands. About 29.17% also do petty trading and food preparation for sale.

All the women processors interviewed are married with children.

CASSAVA PROCESSING TECHNOLOGY IN THE STUDY AREA

Source of Cassava

Cassava for processing is obtained from processors own farms and other farmers in the localities. However, the respondents reported that the larger proportion of cassava for processing is bought from other farmers. The cost per rope of cassava range between ₦30,000 and ₦55,000 depending on the maturity and yield.

Cassava Varieties Used

Two cassava varieties are commonly used for processing. There are Yebeshie (Togolese) and Biafra. The main reason adduced is that the varieties are high yielding. Also Biafra has low moisture content and gives high product recovery rate when processed.

Pre Processing Activities

These involve harvesting and transportation. In the study area, both activities are mostly carried out on contract basis. Harvesting cost per rope of cassava farm is estimated at ₦6,000.00. Three means of transportation of uprooted cassava are available.

These include haulage by head load, trolley and vehicle. Transportation cost per rope of uprooted cassava by headload, trolley and vehicle are ₦3,000, ₦6,000, and ₦10,000 respectively. The use of trolley is relevant in the study area.

Traditional Gari Processing

Traditional gari processing in the study involves peeling, washing and grating, fermenting and pressing cassava mash, disintegrating the dough and roasting the meal to obtain gari. Gari is sifted to remove the larger lumps and fibres (See Figure 1).

Peeling

In most cases, the head section of cassava tuber is peeled off first. This is then passed onto another person who holds the peeled portion whilst the tail portion is peeled. Peeled cassava is much cleaner using this method and less effort and water is used in washing.

The majority of the processors used hired labour to peel cassava. About 4 man days are used to peel 600kg (average weight of a rope of cassava) of cassava @ ₦2,000 to ₦2,500 per man day.

Washing

River or well water is used to wash peeled cassava. About 50 litres of water is used to wash 600kg of peeled cassava. Usually washing does not attract any cost. This is performed by the processors and their children.

Grating

This is done mechanically by the use of grating machines sited in the localities, but owned mostly by individuals outside the localities. Some of the grating machine owners also have screw presses. Thus in such situations grating and dewatering costs are lumped together. However, at Danfa, there is a complete processing unit established by the 31st December Women Movement for the women processors. It was observed that, harvested tubers are promptly peeled, washed and grated on the same day. Only in extreme cases will at most two days elapse before processing commence.

Fermentation and Dewatering

The grated mash is left overnight for some starch to breakdown and facilitate subsequent dewatering. Fermented mash is pressed in polypropylene sacks to achieve ideal moisture content for roasting.

Dewatering is done in three ways. These include the use of screw presses, stones and parallel board. However, the use of screw presses is common. This takes about 24 hours.

Disintegrating and Roasting

These are done concurrently. Caked dough is disintegrated on bamboo or palm frond sieve placed on a tin basin by one person whilst 2-3 persons will be roasting in sieves. A roaster (aluminium basin) fixed out a traditional hearth is used in roasting and a piece of calabash used to stir the dough in the slowly heated basin intermittently. About ₦7,000.00 to ₦15,000.00 worth of fuel wood is used to roast a batch of grated mash.

Sifting

After roasting, gari is sifted to remove fibres and lumps, which may be milled and sold separately or mixed with the final product for sale.

Cooling

Gar is cooled before packaging in polyethylene line polypropylene sacks.

Capacities and Recovery Rates

Averagely, 2 ropes about (1200kg) of fresh cassava is processed per processor in a week. About 220kg of gari is obtained from a batch.

Marketing

Most of the respondents (83.33%) sell their products in the locality. The few who sell outside their localities visit Mallam Atta Market.

Transportation and handling cost per bag of gari range between €1,500.00 to €3,000.00 depending on the distances involved. Selling price of gari range between €1,500.00 to €1,800.00 per 'olonka'.

Traditional Agbelima Processing

Traditional agbelima processing involves peeling, washing, grating and fermentation and dewatering (See Figure II).

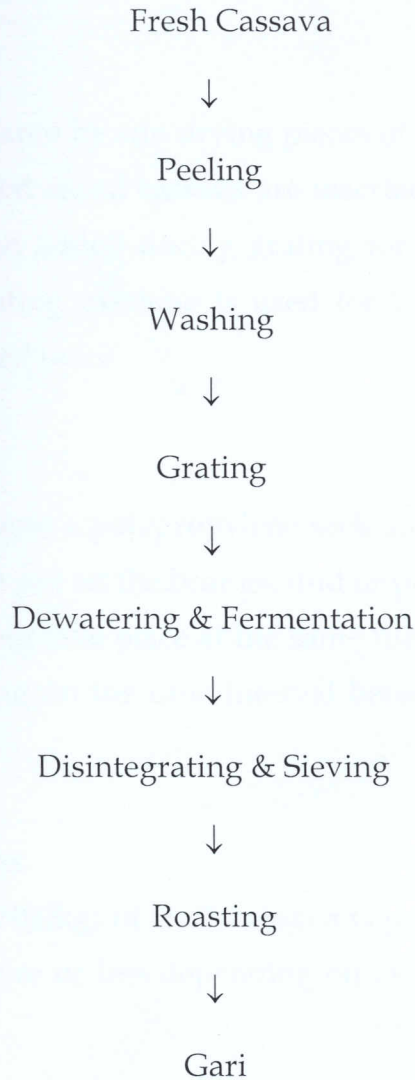


Figure I. The traditional method for gari production in the Ga District

Peeling

This is done as described under gari processing.

Washing

Majority (75%) of the respondents in the study area do not wash peeled cassava for agbelima processing. They claimed that peeled cassava is cleaner and any remaining dirt is drained at the dewatering stage.

Grating

Firstly, an inoculum is prepared by sun drying pieces of peeled cassava for about 10 -12 hours. Afterwards, the dried sliced cassava are inserted in a thatch roof for at least 3 days. The inoculum is then added during grating for smoothening of the mash. In places where the same grating machine is used for both gari and agbelima, peeled cassava for agbelima is grated twice.

Fermentation & Dewatering

The grated mash is loaded into a polypropylene sack and pressed by placing stones on the sacks. The sacks may be put on the bear ground or pieces of wood.

Fermentation and dewatering take place at the same time. Fermentation may continue during marketing depending on the time interval between processing and marketing one or more days.

Capacities & Recovery Rates

Averagely, about 4 ropes (2400kg) of fresh cassava is processed in a week. However a processor might process more or less depending on availability of market, labour and regular supply of cassava.

Marketing of Agbelima

Agbelima is sold outside the localities, mainly at Mallam-Atta, Madina and

Agbogbloshie Markets. Most of the processors visit a particular market once a week. This control supply of Agbelima on the market.

Transportation and handling charges per minibag of agbelima range between ₦400.00 to ₦600.00 depending on the distance involved. The women accompany their loads free of charge but pay for their return journey. Market toll charged on a minibag of Agbelima is about ₦200.00. A minibag of agbelima sells between ₦6,000.00 and ₦8,000.00.

By Products

These include cassava peels, fibre and cassava pieces from disintegrated dough. In the study area, cassava peels are either thrown away or fed to livestock or sold. Fibre and cassava pieces are dried and processed into kokonte for home consumption.

CONSTRAINTS

Some of the constraints enumerated by gari processors include high cost of fuelwood, labour and drudgery involved in processing.

The agbelima processors however complained about lack of market. Thus supply levels are highly controlled by market women to reduce excess supply on the market.

AGBELIMA PRODUCTION

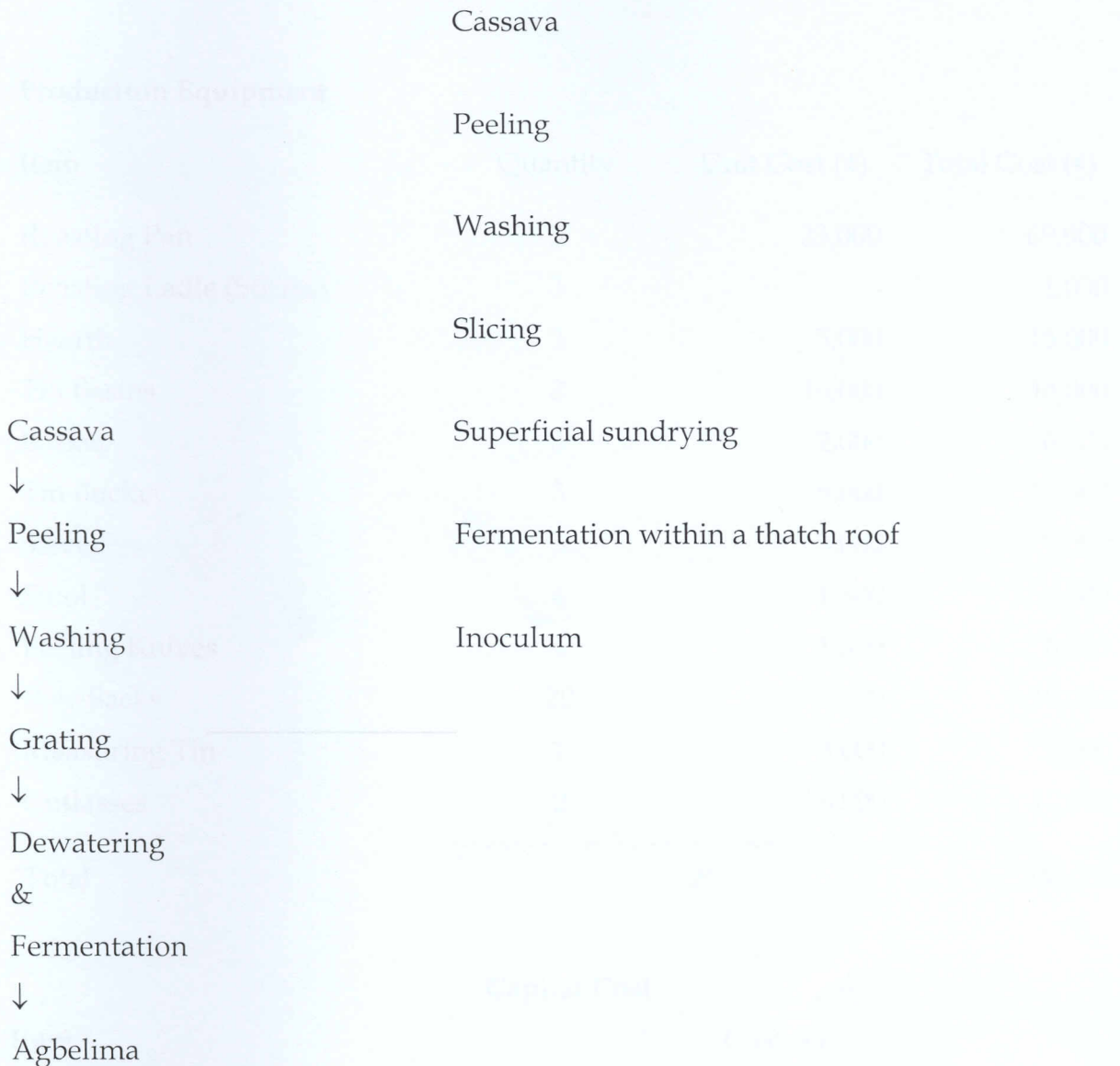


Figure II. Traditional processing of cassava into agbelima in the Ga District.

**BREAKEVEN ANALYSIS FOR TRADITIONAL GARI PROCESSING IN GA
RURAL DISTRICT (FOR ONE WOMAN PROCESSOR)**

Production Equipment

Item	Quantity	Unit Cost (₹)	Total Cost (₹)
Roasting Pan	3	23,000	69,000
Roasting Ladle (Stirrer)	3	-	1,000
Hearth	3	5,000	15,000
Tin Basins	3	16,000	48,000
Basket	3	2,000	6,000
Tin Bucket	3	5,000	15,000
Sieve	3	3,000	9,000
Stool	4	1,500	6,000
Peeling Knives	4	1,500	6,000
Poly Sacks	20	500	10,000
Measuring Tin	1	3,000	3,000
Cutlasses	2	6,000	12,000
Total			200,000

Capital Cost

Item	Cost (₹)
Land (12" x 12")	50,000
Shed	200,000
Total	<u>250,000</u>
Total Equipment + Land + Shed	450,000
10% Contingency	45,000
Total Capital Cost	495,000

Depreciation

Item	Cost	Useful Life	Annual Depreciation Cost
Shed	200,000	10	20,000
Roasting pan	69,000	10	6,900
Hearth	15,000	5	3,000
Tin Basins	48,000	5	9,600
Tin Bucket	15,000	5	3,000
Cutlasses & Knives	18,000	2	9,000
Stools	6,000	2	3,000
Measuring Tin	3,000	2	1,500
Sieve & Roasting Ladle	10,000	1	10,000
Total			66,000

Total Fixed Cost Without Financing

Depreciation	66,000.00
maintenance/Repairs	33,000.00
Salaries	-
Total Annual	99,000.00
Total Monthly	8,250.00

Monthly Variable Labour Cost

Production Step	Man days	Cost/Monday (€)	Total Cost (€)
Harvesting	Contract	-	48,000
Transportation	Contract	-	48,000
Peeling & Washing	32	2,500	80,000
Disintegrating	12	2,000	24,000
Roasting & Sifting	36	2,500	90,000
Total			290,000

Total Variable Cost

Variable Input	Cost (€)	% of Total
Raw material	368,000	50.21
Labour	290,000	39.51
Water	5,600	0.76
Firewood	38,332	5.23
Poly Sacks	10,000	1.36
Milling & Pressing	21,000	2.87
Total	732,932	100.00

$$\text{Break Even Quantity} = \frac{\text{Fixed Cost}}{\text{Price} - \text{Variable Cost}}$$

$$\text{Monthly Fixed Cost} = 8,250$$

Price (C/Olonka, 2.2 kg)	=	1,700
Variable Cost (C/Olonka, 2.2 kg)	=	1,832.33
Gross Margin (Price - Variable Cost)	=	-132.33

ASSUMPTIONS FOR TRADITIONAL GARI PROCESSING

1. Traditional processor's capacity is about 2 ropes of cassava per week, working 4 weeks a month. Capacity per month is 4800kg (8 ropes).
2. Averagely, about 400 'olonka' is processed per processor in a month.
3. Maintenance/Repairs a. Half depreciation.
4. Direct labour costs are assumed.
5. Averagely, about ₦9,583 worth of fuel is used to roast a batch of cassava dough.
6. About ₦1,400 worth of water is used to wash a batch of peeled cassava.
7. Marketing is mostly done in the locality, hence no market expenses are incurred.

BREAKEVEN ANALYSIS FOR TRADITIONAL AGBELIMA PROCESSING IN GARURAL DISTRICT (FOR ONE PROCESSOR)

Production Equipment

Item	Quantity	Unit Cost (¢)	Total Cost (¢)
Tin Basins	6	16,000	96,000
Peeling Knives	6	1,500	9,000
Polysacks	40	500	20,000
Stools	6	1,500	9,000
Polyethylene	20	300	6,000
Total			140,000
10% Contingency			14,000
Total Capital Cost			154,000

Depreciation Cost

Item	Cost (¢)	Useful Life	Annual Depreciation
Tin Basins	96,000	5	19,200
Peeling Knives	9,000	2	4,500
Stools	9,000	2	4,500
Total			28,200

Total Fixed Cost Without Financing

Depreciation	28,200.00
Maintenance/Repairs (50% of Depreciation)	14,100.00
Salaries	-
Total Annual	42,300.00
Total Monthly	3,252.00

Monthly Variable Labour Cost

Production Step	Man days	Cost/Monday (¢)	Total Cost (¢)
Harvesting	Contract	-	96,000
Transportation	Contract	-	96,000
Peeling & Washing	64	25,000	160,000
<hr/>			
Total			352,000

Total Variable Cost

Variable Input	Cost (¢)	% of Total
Raw material	740,000	54.96
Labour	352,000	26.15
Milling	58,720	4.36

Poly Sacks & Polyethylene	26,000	1.93
Market Expenses	169,000	12.60

Total	1,346,320	100.00
-------	-----------	--------

$$\text{Break Even Quantity} = \frac{\text{Fixed Cost}}{\text{Price} - \text{Variable Cost}}$$

Monthly Fixed Equipment Cost	=	3,525.00
------------------------------	---	----------

Price (C/minibag)	=	7,000.00
-------------------	---	----------

Variable Cost (C/minibag)	=	6,350.57
---------------------------	---	----------

Gross Margin (Price - Variable Cost)	=	649.43
--------------------------------------	---	--------

BEQ (minibag/month)	=	5.43
---------------------	---	------

ASSUMPTIONS FOR TRADITIONAL AGBELIMA PROCESSING

1. Traditional processor's capacity is about 2400kg (4 ropes) of cassava per week, working 4 weeks a month. Therefore, capacity per month is equivalent to 9600kg fresh cassava.
2. It is assumed that peeled cassava for agbelima processing is not washed since about 75% of the total sample interviewed do not wash the peeled cassava before grating.
3. Averagely, about 212 minibags of agbelima is processed per processor in a month.
4. Maintenance/Repairs cost is estimated at half of depreciation cost.
5. Market expenses consist of costs of transportation to market, handling and market toll charges.

CONCLUSIONS

Below are the conclusions drawn from the study:

1. Majority of the women processors are illiterates.
2. On the average about 1200kg and 2400kg of fresh cassava are processed into gari and agbelima respectively per processor in a week.
3. Traditional gari processing activity is not financially viable. Total cost far exceeds revenue generation.
4. Gari is underpriced by the traditional processors since they do not capture all the cost elements in pricing.
5. Agbelima processing activity is financially viable but has limited market as compared to gari.
6. Constraints reported by gari processor include health related problems like waist pains, drudgery involved in processing, high cost of labour and fuelwood.
7. Agbelima processing activity is constrained by lack of market.

APPENDIX I REGIONAL PRODUCTION ESTIMATES OF CASSAVA IN GHANA
(1996)

Region	Production Level (Metric Tonnes)
Western	540,340
Central	632,891
Eastern	1,958,400
Greater Accra	206,672
Volta	984,700
Ashanti	1,191,481
Brong-Ahafo	1,468,465
Northern	128,233
Upper East	-
Upper West	-

Source: PPMED, MOA (Agric Statistics & Census Division)

APPENDIX II A. AREA ESTIMATES OF CASSAVA IN GHANA 1990 - 1996

Year	Estimated Area in Hectares
1990	322,800
1991	534,700
1992	551,900
1993	531,800
1994	520,400
1995	551,300
1996	590,700

Source: PPMED, MOA, Accra

B. PRODUCTION ESTIMATES OF CASSAVA IN GHANA: 1990 - 1996

Year	Production Estimates in '000MT'
1990	2,717.0
1991	2,701.5
1992	5,662.0
1993	5,972.6
1994	6,025.0
1995	6,611.4
1996	7,111.2

Source: PPMED, MOA, Accra.

Food Research Institute



Editorial Committee

1.	Dr. Wisdom A. Plahar	Chief Research Scientist	Chairman
2.	Dr. Wisdom K. Amoa-Awua	Principal Research Scientist	Member
3.	Dr. Kafui A. Kpodo	Principal Research Scientist	Member
4.	Dr. P-N. T. Johnson	Senior Research Scientist	Member
5.	Robert M. Yawson	Senior Scientific Secretary	Secretary