CORAF/WECARD

Staple Crops Programme

Global Food Security Response Initiative

TRAINING MANUAL

PROCESSING OF CASSAVA INTO GARI AND HIGH QUALITY CASSAVA FLOUR IN WEST AFRICA
TRAINING MANUAL

PROCESSING OF CASSAVA INTO GARI AND HIGH QUALITY
CASSAVA FLOUR IN WEST AFRICA

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Cassava is versatile in food preparation and processing where women are actively engaged, and is consumed by all sections of the populations, including the very poor as the cheapest source of calories and in several products in Africa. Post-harvest losses could exceed 30% during the period of glut in the year. The high post-harvest losses could provide an opportunity to process cassava, increase incomes and achieve food security in the rural areas of Africa.

The training manual is designed to train agro-processing stakeholders, including food specialists, scientists, extension workers and agro-processors. The contents have been designed to orient target groups into professional agri-business entrepreneurs. This will be achieved through capacity strengthening, which will facilitate the adoption of best practices, mastery of the processing techniques, compliance to norms of product quality and the adoption of agro-business principles. The optimum application of the manual will eventually transform rural population into food secure communities and wealth creators.

Guy Médard LOUEKE,  
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Among the major food crops, cassava ranks second to rice in West and Central Africa with potential economic value of US$ 4.7 billion over the next 10 years. Cassava has several advantages due to its adaptation to wide range of agro-ecologies (forest, forest-Savannah transition and Savannah zones), its rapid expansion in all these zones, its ability to produce reasonable yields under stresses and its versatility in usage. Post-harvest losses in cassava estimated at 30% mostly occur at the period of glut, while output of processors could reduce by 40% during the dry season due to scarcity of raw material resulting from drudgery and high harvesting cost. The efficiency of the traditional methods of cassava processing could be low and laborious with low turnover and sometimes injurious to health. A blend of 10% cassava flour with wheat flour alongside the increasing demands for traditional cassava products provide an opportunity in turning losses into foods and incomes. The project, Improving post-harvest quality and packaging of rice, sorghum/millet and cassava products to enhance marketability in West Africa aims to put efficient technological packages in the hands of cassava producers in improving efficiency and profitability in processing. It is an initiative of CORAF/WECARD, funded by the USAID and coordinated by the Songhai Centre.

Through project activities, strengths, expertise and resources are being mobilized to promote appropriate post-harvest technologies. The project seeks to strengthen capacities of target groups to enable them adopt efficient processing techniques, whilst facilitating processors’ access to the acquisition of simple processing equipment through linkages to relevant institutions. Target countries for cassava processing are Benin, Togo, Nigeria and Ghana. The manual is a product of concerted efforts of key stakeholders (from the respective National Agricultural Research Institutes (NARIs), IITA and the Songhai Centre). The manual has been well structured and provides methodological steps, tailored to the training needs of trainers - researchers, extension agents and agro-processors. Effective use of it will help reduce cassava post-harvest losses and improve market access of cassava products in ensuring food security and increased incomes of cassava producing communities.

Dr. Paco SEREME  
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The Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricoles/West and Central African Council for Agricultural Research and Development [CORAF/WECARD] was established in 1987 as conference for African and French Agronomic Research Directors. In 1995 it widened its coverage to include English and Portuguese speaking countries of West and Central Africa. It comprises 22 member states including Benin, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Congo, Cote D'Ivoire, Democratic Republic of Congo, Gabon, The Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo. The land area is 11.5 millions km² and the population is 318 millions out of which 65% are engaged in agriculture.

**CORAF/WECARD VISION**

“...A sustainable reduction in poverty and food insecurity in WCA through an increase in agricultural-led economic growth and sustainable improvement of key aspects of the agricultural research system…”

**CORAF/WECARD MISSION**

“...Sustainable improvements to the productivity competitiveness, and markets of the agricultural system in West and Central Africa by meeting the key demands of the sub-regional research system as expressed by target groups…”

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*Processing of Cassava into Gari and High Quality Cassava Flour in West Africa*
Introduction

1.1 Background

Cassava is one of the most important root crops in Africa. Sixty percent of the population of Sub-Saharan Africa (SSA) depends on cassava as a staple food crop. Through its production, marketing and processing, cassava provides a major source of household income, often for women and the very poor. New Partnership for Africa’s Development (NEPAD) (2004) has identified cassava as a poverty-alleviation crop and has developed a market-oriented strategy for the sub-sector, based on the Global Cassava Development Strategy (GCDS). This choice is partly due to the recognised importance of the crop as a famine reserve, its production being relatively simple, demanding low agronomic inputs with little or no fertilisation. Other advantages of the crop include: its efficiency in calorie production compared to other crops (accounting for 30% daily calorie intake in Ghana); its flexibility in planting and harvesting time, and drought-resistance. Cassava is reliable as a food source thus making it a crop of choice in Africa.

Cassava is a perishable commodity with a shelf life of less than 3 days after harvest. Processing provides a means of producing shelf stable products (thereby reducing losses), adding value at a local rural level and reducing the bulk to be marketed (Phillips et al., 2005). As urban population expands, the demand for more convenience and shelf-stable foods increases. Some cassava foods, such as Gari, tapioca, and attieke, are highly prized by urban populations, and these have managed to retain their markets. Imported food products are important urban foods but there is still a high demand for traditional foods, although they are often considered less acceptable because of concerns of quality and safety (Sanni et al., 2007).

In Africa, cassava is currently utilised for two main purposes: human food and industrial usage. Estimates for the percentage of cassava used for industrial utilisation range from 5 to 16% while the rest is used directly for human consumption. Most of cassava’s industrial utilisation is for animal feed. About 10% of its industrial demand consists of high-quality cassava flour used in biscuits and other confectioneries, dextrin, pre-gelled starch for adhesives, and starch for pharmaceuticals and seasonings.
Failure to adequately develop post-harvest and marketing systems for cassava has for many years, limited the contribution of the crop in economic growth and poverty reduction. There have been pockets of very innovative technical research works towards, understanding the mechanisms of cyanogens reduction during processing (Sanni and Jaji, 2003; Aerni, 2004), development of cassava processing equipment and of the commercial/industrial applications of cassava (Westby et al., 2001).

In spite of the extensive research activities on cassava, there seems to be wide variation with no control on the processing of cassava within and among the countries of the sub-region. There is therefore the need to have a document containing standardised procedure in processing the products and empower processors and other stakeholders for commonality in quality and competitive market.

1.2. Constraints of Gari and High Quality Cassava Flour (HQCF) processing

Gaps in knowledge contribute to a number of problems/constraints in cassava processing. These include low multiplication rates because of vegetative propagation, and labor intensive production and processing.

Fresh cassava is highly perishable, with a shelf life of less than 3 days. Hence, processing which provides a means of producing shelf stable products for value addition is important. The root is also very bulky, (containing about 70% moisture), making processing close to the supply source economical.

Other identified problems include traditional processing methods, which give poor/low product yields; current practices of use of mixed varieties in processing create problem in product quality consistency; finished product safety not guaranteed as a result of non-availability of standards, poor product packaging and storage, and low productivity as a result of no to low use of modern equipment. Most of the equipment needed for processing cassava into Gari and High Quality Cassava Flour (HQCF) are being produced in West Africa but the right materials (e.g. Stainless steel) are not used in manufacturing some of them. The efficiencies of the peeling machines need to be improved upon with respect to the peeling loss incurred and inability to completely peel the roots. All these problems could result in non-competitiveness of the products in the global market.
1.3. Justification

The vision for cassava is that it will spur rural industrial development, helping to raise incomes for producers, processors and traders while contributing to national food security, by a shift from cassava as principally a subsistence food crop to an industrial crop for export trade.

One of the approaches to achieve this goal is to have a document, in the form of a manual that addresses cassava product standards in terms of production, processing, storage and distribution. The manual can be used by cassava stakeholders in the sub-region to consistently produce good quality products with competitive advantage in the global market.

Currently, available manuals on cassava processing are mainly found in Nigeria and Ghana, but the manuals only address recipes of the country-specific products, which may or may not be found in other West African countries. There is a dearth of information for trainers on cassava processing in the sub-region; this therefore gives room for fluctuation in product quality hence, lack of competitiveness in the global market. Having a manual for trainers in West Africa for cassava processing would go a long way in improving the enterprise.

This training manual intends to give guidelines in cassava processing for Trainers, namely, extension workers, NGOs, cooperatives and other cassava stakeholders who would use it to empower processors, farmers at the grassroots and also those in small to medium scale cassava enterprise.

1.4 Objectives of the training manual

1. To standardise Gari and HQCF processing technologies in West Africa

2. To develop a manual for training cassava stakeholders on processing and packaging of good quality and safe cassava products (Gari and HQCF) for competitive market in West Africa
1.5 Development of the training manual

The training manual development was part of the mandate of the CORAF project. The project identified and brought together cassava processing experts from Nigeria, Ghana, Togo and Benin who are from relevant ministry sectors, research and academic institutions. The team made use of experience, information gathered from literature and existing practices to put together this manual for use among cassava stakeholders in West Africa for improved practices and productivity.

1.6 Structure of the training manual

The manual focuses on two common products from cassava in West Africa, which are Gari and high quality cassava flour. Each of the products is described with details of processing using flow charts and diagrams for the trainers’ use. Each product identifies training needs, people and equipment, for trainer’s use. It therefore contains all that the trainers need to empower cassava processors and other stakeholders at all levels to produce good quality and safe products.
2.1 Background Information

Gari is a partially gelatinised (by toasting), free-flowing granular flour with a slightly fermented flavor and sour taste. In West Africa, it is the most consumed and traded of all food products made from cassava roots. It is consumed either soaked in cold water or by stirred in boiling water to make a stiff paste and consumed with a choice of soup. Gari can be yellow (if fortified with red palm oil) or white, although gari from bio-fortified cassava is gaining popularity now. Seventy percent (70%) of cassava processed as human food is Gari (Oduro et. al., 2000). Its wide consumption is attributed to its relatively long shelf life and its easy preparation as a meal.

There are variations in the Gari produced within the sub-region in terms of physical, chemical and sensory qualities. However, the processing method used in this manual captures all variations as much as possible. It also emphasises precautions on unit operations that have implications on finished product quality and safety.

A trainer on Gari processing should familiarise the trainees on the following;

- Training objective
- Training needs

2.2 Training objective

To empower trainees to produce good quality and safe Gari for consumption and/or commercialisation

Training Needs

The trainer must have a checklist, which contain the following
2.3 Materials

a) Raw material-Cassava roots  
   Basins for washing and packing washed roots
b) Clean washing water
c) Clean stainless knives for peeling
d) Clean sacks for fermenting cassava mash
e) Sieve/sifter
f) Fuel for toasting/roasting/Garifying; (fire wood, charcoal or cooking gas)
g) Packaging materials for finished product
h) Clean cloth or used sacks for washing

2.4 Equipment

i) Cassava grater
j) Cassava press
k) Gari toaster/Gari roaster/Garifyer
l) Sealing and stitching machines
m) Weighing scale
n) Mechanical sifter (for medium to large scale processing)
o) Fermenting trough

The trainer should ensure that all the above are available before the training.
Fig. 1  Process Flow Chart for Gari from Cassava roots
Cassava roots: Use fresh cassava roots harvested 10-12 months after planting. The fresh roots must be healthy without rot and well handled from farm.

**Note:** (Educate farmers, processors and marketers to stick to a particular variety for a particular product; they should be familiar with their varieties and discourage the use of mixed varieties in processing)

**Sorting:** Select healthy roots from the lot for processing. Discard poor quality roots.

**Peeling:** Peel with clean stainless steel knives and remove woody tips. Ensure that the rind is completely removed and avoid excessive waste of roots

Mechanical peelers are available in medium-to large-scale processing.

**Note:** sorting and peeling can be done simultaneously in small scale processing.

Fig. 2: Peeling
**Washing:** Wash peeled roots in clean water at least twice to remove pieces of peel, sand and other dirt. Clean cloth and used sack can also be used to facilitate washing.

**Grating:** Grate roots properly in clean stainless steel grater to obtain uniformly smooth mash.

The grated mash must be uniformly smooth without lumps. In case of non-uniform mash, grate again until smooth mash is obtained. The smoothness of the mash determines the quality, yield and market value of the finished Gari.

**Fig. 3: Grating**
**Fermenting:** Put cassava mash into a clean sack and tie. Allow to stand in a fermenting trough for 2-4 days. Arrange sacks in such a way that there is no contact with sand or dirt that can contaminate the mash. Allow free seeping of water from the sacks.

There are variations in fermentation period within and among countries. However, fermentation should not be less than 2 days (to allow development of the characteristic sour taste of *Gari*).

*Fig. 4: Fermentation*

(Please ask your trainees for common practice with respect to this and follow what is acceptable to them. In cases of fermentation of less than 2 days, please educate processors and discourage the practice. Also prolonged fermentation, beyond 3 days, should be discouraged to ensure adequate starch content in the product.)

**NOTE:** “The practice of processing cassava roots which have been stored overnight into *Gari* without fermenting the mash should be discouraged”
Pressing: The fermented mash in sacks is pressed to remove as much moisture as possible. Pressing is completed when water is no longer dripping from the sacks. If dewatering is not complete, there would be lumps during toasting which reduces quality and yield of *gari*. The pressing time depends on the efficiency of the press and moisture content of the mash.

Sacks should not be used for too long to prevent bursting during pressing. In case of light sacks or over-use of sacks, it is advisable to double the sacks.

Note: Currently, there are different types of press with different capacities and efficiencies.

The press and the pressing area should be kept very clean with good drainage system for safe disposal of the effluent to avoid environmental pollution and public health hazards.
Cake breaking/Sifting or Sieving: Cake breaking is done using clean hands followed by sifting with non-rusting sifter into clean basin. Sifter made of stainless steel material is preferable.

![Fig. 6: Sifting](image)

Toasting/Roasting/Garifying: Toast and stir constantly in a large, shallow cast-iron pan over fire, with a piece of gourd or a wooden paddle until the Gari is dried through hand feel. This may take 20-30mins depending on the heat source and quantity of sifted cake.

The finished product (Gari) is usually recognised by the colour change from white to cream (for non-palm oil fortified Gari) and crispy hand feel of the grains/particles.

Toasting can also be done mechanically using an automated Garifyer or other improved Garifyer made of stainless steel material and with firewood or charcoal as the heat source.
Fig. 7: Toasting

**Cooling:** The toasted *Gari* should be collected into a clean basin and spread on a raised platform lined with clean polythene material or white cloth to cool to room temperature.

**Sieving:** Sieve to obtain granules of uniform size.

**Packaging:** Pack desired quantities in polythene bags and/or sacks, seal or stitch as appropriate. Properly label the packages according to the standards of national regulatory agencies. *Gari* should be packaged in clean, insect- and moisture-proof materials that guarantee the wholesomeness of the product and the retention of its nutritional, physical and sensory qualities. The packaging should not impart any toxic substance or undesirable odour/flavor to the product. This product could be packaged in polypropylene sacs lined with thin polythene material for bulk sales, or in smaller bags (paper, polythene/polypropylene) as unit packages for retail market. The unit packages could be arranged into secondary packages of cardboard boxes.
In labelling, the following information about the product should be provided:

- The common name and/or brand name
- Name of the manufacturer or packer
- Batch or code number
- Net mass (in metric units)
- Date of manufacture
- Country of origin
- Expiry date
- Preparation, nutritional and storage information should be attached.
- Other information required by the national regulatory agencies.

**Storing:** Store in a cool, dry, well ventilated, insect and rodent free store/enclosure.

### 2.5 Processing environment

The trainer should emphasise the need for clean processing environment at the training for product safety and public health.
CHAPTER 3: Training on high quality cassava flour (HQCF) processing

3.1 Background Information

High quality cassava flour (HQCF) is a fine flour produced from wholesome freshly harvested cassava (10-12 months after planting) and rapidly processed roots. HQCF is an unfermented, smooth, odourless, white or creamy flour, bland with no gluten. Commercial production of HQCF is relatively new in Africa. As a result of increase in the price of wheat in the international market and unfavourable exchange rates in West Africa, high quality cassava flour (HQCF) was introduced and is now gradually gaining popularity in the sub-region.

HQCF has contributed appreciably to cassava industrial revolution especially in Nigeria and Ghana (Sanni et al, 2009), with enormous potentials in the other countries within the sub-region. The product has been found to be suitable for making a variety of pastries, whole or in the composite forms (cakes, cookies, doughnuts and breads) and convenience foods. It is also an acceptable raw material for the manufacture of industrial items such as textiles, plywood, paper, etc. (Dziedzoave et al, 2006). The processing of cassava roots into HQCF as a primary industrial raw material has the potential to jump-start rural industrialisation, increase market value of cassava and improve farmers’ earnings and their livelihoods.

Governments of some cassava-growing nations are making efforts to promote competitive production and processing of cassava into industrial raw materials for import substitution and foreign exchange earnings (Dziedzoave et al, 2005). To achieve this, policies and laws are being put in place to promote market diversification and expanded utilisation of HQCF.

A trainer on HQCF processing should familiarise the trainees on the following:

- Training objective
- Training needs
3.2 Training objective
To empower trainees to produce HQCF for domestic and commercial use.

Training Needs
The trainer must have a checklist, which contain the following

3.3 Materials
a. Raw material - Cassava roots
b. Basins for washing and packing washed roots
c. Clean washing water
d. Clean stainless knives for peeling
e. Packaging materials for finished product
f. Clean cloth or used sacks for washing
g. Clean sacks for dewatering
h. Black polythene sheet for sun-drying

3.4 Equipment
i. Cassava grater
j. Cassava press
k. Dryer (mechanical, solar)
l. Milling machine
m. Sealing and stitching machines
n. Weighing scale
o. Mechanical sifter
p. Slicer/Chipper
q. Elevated Platform for solar drying

The trainer should ensure that all the above are available before the training
Fig. 8: Flow Chart for production of HQCF from Cassava roots
Cassava roots: Use fresh cassava roots harvested 10-12 months after planting. The fresh roots must be healthy without rot and well handled from farm. The roots should be processed within 12 hours after harvesting.

**Note:** Educate farmers, processors and marketers to stick to a particular variety for a particular product, they should be familiar with their varieties and discourage the use of mixed varieties in processing.

“Processors should be enlightened to process roots which are not older than 12 months. This helps to improve their yields and meet industrial standards for starch and fiber”

Sorting: Select healthy roots from the lot for processing. Discard unwholesome roots.

Peeling: Peel with clean stainless steel knives and remove woody tips. Ensure that the rind is completely removed to ensure low fiber and white color of the finished product. Avoid excessive waste of roots during peeling.

Mechanical peelers are available in medium to large scale processing.

Washing: Wash peeled roots thoroughly in clean water to remove pieces of peel, sand and other dirt. Pieces of clean cloth and used sack can also be used to facilitate washing.

Grating: Grate roots properly in clean stainless steel grater to obtain uniformly smooth mash.

The grated mash must be uniformly smooth without lumps. In case of non-uniform mash, grate again until smooth mash is obtained. The smoothness of the mash determines the quality, yield and market value of the finished HQCF.

Pressing: The mash is loaded into sacks and pressed to remove as much moisture as possible. Pressing is completed when water is no longer dripping from the sacks. Complete dewatering facilitates drying. Pressing should be done immediately after grating to avoid the onset of fermentation. The pressing time depends on the efficiency of the press and moisture content of the mash.

Sacks should not be used for too long to prevent bursting during pressing. In case of light sacks or over-use of sacks, it is advisable to double the sacks.
The press and the pressing area should be kept very clean with good drainage system for safe disposal of the effluent to avoid environmental pollution and public health hazards.

**Cake breaking/Sifting or Sieving:** Cake breaking is done using clean hands followed by sifting with non-rusting sifter into clean basin. It can also be done by placing the pressed cake back into the grater and disintegrate for drying. Sifter made of stainless steel material is preferable.

**Chipping/Slicing:** This unit operation should be used for processing only low cyanide cassava varieties (cassava containing less than 100mg/Kg HCN<sub>eq</sub>). It makes use of a manual or motorised slicer or chipper. In manual chipping the roots should be thinly sliced to facilitate the drying process.

It is a simple operation with the advantage of yielding a product with slightly higher starch content but compromises on other quality requirements like colour, odour and taste to a large extent if drying is not done rapidly.

It should not however be used for cassava with high cyanide content (more than 100mg/Kg HCN<sub>eq</sub>) because the process does not afford sufficient contact between endogenous enzyme (linamarase) and cyanogens for effective detoxification of the product.

*Fig. 9: Sifting*
**Drying:** Dry the disintegrated/sifted cake in a dryer to reduce moisture to acceptable level according to national regulatory standards. Sun drying, use of mechanical or solar dryer can be employed to reduce the moisture.

Sun-drying should be carried out by spreading the sifted mash or the chips on an elevated platform covered with a black polythene sheet. The black polythene facilitates drying by absorption of solar heat and the elevated platform prevents dust and other dirt from contaminating the drying product.

“The trainer should strongly emphasise the need to dry the pressed mash and the chips rapidly to prevent fermentation which would impart unacceptable flavour to the pastries produced from the HQCF”

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Fig. 10 A: Sun drying on raised platform

Fig. 10 B: Sun drying
Milling: Milling is done to obtain fine textured flour using hammer mill or disc attrition mill.

Fig. 10 C: Cabinet dryer

Fig. 11: Milling process using disc attrition mill and hammer mills
CHAPTER 4: Packaging/Labelling

Pack desired quantities of HQCF in polythene bags and/or sacks, seal or stitch as appropriate. This avoids absorption of moisture of the flour from the environment. Label the packages properly according to the standards of national regulatory agencies.

HQCF should be packaged in clean, insect- and moisture-proof materials that guarantee the wholesomeness of the product and the retention of its nutritional, physical and sensory qualities. The packaging should not impart any toxic substance or undesirable odour/flavor to the product. This product could be packaged in polypropylene sacs lined with thin polythene material for bulk sales, or in smaller bags (paper, polythene/polypropylene) as unit packages for retail market. The unit packages could be arranged into secondary packages of cardboard boxes.

In labelling, the following information about the product should be provided:

- The common name and/or brand name
- Name of the manufacturer or packer
- Batch or code number
- Net mass (in metric units)
- Date of manufacture
- Country of origin
- Expiry date
- Preparation, nutritional and storage information should be attached.
- Other information required by the national regulatory agencies.
Fig. 12 A: Packaging of HQCF

Fig. 12 B: Storage in sacks

**Storing:** Store in a cool, dry, well ventilated, insect and rodent free store/enclosure.
**Processing environment**

The trainer should emphasise the need for clean processing environment at the training for product safety and public health.

**Food uses of HQCF**

As mentioned earlier, there are various uses of HQCF in the food industry; HQCF is useful in the convenience or fast food industry for making a variety of pastries at 100% level of substitution for wheat or as a composite of wheat flour particularly for bread making. It is very acceptable as a raw material in the food and beverage industry for the manufacture of biscuits, noodles, baby foods, alcoholic drinks, etc, and as a binding or thickening agent in soups/sauces.

Standard recipes for production of HQCF-based pastries have been developed in some countries within the sub-region. Hundred percent substitution for wheat flour is possible in the production of a large number of HQCF-based confectioneries but greater quantities of bakery fats and other texture enhancing ingredients would also be required for the preparation of acceptable products.

**Table 1: Percentage HQCF substitution in pastries**

<table>
<thead>
<tr>
<th>Pastries</th>
<th>Substitution level (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bread</td>
<td>10 – 20</td>
</tr>
<tr>
<td>Biscuits</td>
<td>5 – 50</td>
</tr>
<tr>
<td>Cakes</td>
<td>50 – 100</td>
</tr>
<tr>
<td>Pies/Rolls</td>
<td>20 – 50</td>
</tr>
<tr>
<td>Doughnuts</td>
<td>50 – 100</td>
</tr>
<tr>
<td>Chin-chin</td>
<td>100</td>
</tr>
</tbody>
</table>
Fig. 13 : Example of Label
**Chapter 5. IMPACT POINTS ON PROCESSING GARI AND HQCF**

The following table presents a summary of the points the trainer should emphasise to ensure production of good quality, safe and marketable gari and HQCF.

<table>
<thead>
<tr>
<th>Activities</th>
<th>Impact points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Unit operations</strong></td>
<td></td>
</tr>
<tr>
<td>Raw material selection</td>
<td>Process only roots harvested 10-12 months after planting</td>
</tr>
<tr>
<td>Peeling</td>
<td>Peel wholesome roots properly using non-rusting knives</td>
</tr>
<tr>
<td>Washing</td>
<td>Wash peeled roots thoroughly</td>
</tr>
<tr>
<td>Grating</td>
<td>Grate washed roots properly using a grater made of non-rusting material.</td>
</tr>
<tr>
<td>Fermenting (Gari)</td>
<td>Ferment mash for a minimum of 2 days and a maximum of 3 days</td>
</tr>
<tr>
<td>Chipping/Slicing (HQCF from low cyanide cassava)</td>
<td>Chip/slice the washed roots thinly</td>
</tr>
<tr>
<td>Pressing (HQCF)</td>
<td>Press immediately after grating</td>
</tr>
<tr>
<td>Toasting/Roasting</td>
<td>Toast/roast the sieved mash to low moisture content</td>
</tr>
<tr>
<td>Drying (HQCF)</td>
<td>• Dry pressed mash immediately after sieving/cake breaking</td>
</tr>
<tr>
<td></td>
<td>• Commence drying of chips immediately after chipping/slicing</td>
</tr>
<tr>
<td></td>
<td>• Dry the mash or chips to low moisture content on a raised platform covered</td>
</tr>
<tr>
<td></td>
<td>with black polythene sheets.</td>
</tr>
<tr>
<td>Packaging</td>
<td>Package products in well-labelled, insect- and moisture-proof material that</td>
</tr>
<tr>
<td></td>
<td>would not impart any toxic substance or undesirable odour/flavour to them</td>
</tr>
<tr>
<td><strong>2. Hygiene observance</strong></td>
<td>• Personal and environmental hygiene should be strictly observed.</td>
</tr>
<tr>
<td></td>
<td>• Processing equipment should be washed/cleaned before and after use.</td>
</tr>
</tbody>
</table>


6. REFERENCES


### Appendix 1:

**Some national standard specifications for Gari and HQCF**

<table>
<thead>
<tr>
<th>Products</th>
<th>Nigeria</th>
<th>Ghana</th>
<th>Togo</th>
<th>Benin</th>
<th>Code Food</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gari</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisture</td>
<td>12% (max)</td>
<td>12% (max)</td>
<td>12% (max)</td>
<td>10-12%</td>
<td>12% (max)</td>
</tr>
<tr>
<td>Starch</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fiber</td>
<td>2.0% (max)</td>
<td>2.0% (max)</td>
<td>2.0% (max)</td>
<td>2.0% (max)</td>
<td>2.0% (max)</td>
</tr>
<tr>
<td>Cyanide</td>
<td>2.0 mg/Kg (max)</td>
<td>2.0 mg/Kg (max)</td>
<td>2.0 mg/Kg (max)</td>
<td>2.0% (max)</td>
<td>2.0 mg/Kg</td>
</tr>
<tr>
<td>Ash</td>
<td>2.75% (max)</td>
<td>2.75% (max)</td>
<td>2.75% (max)</td>
<td>2.75% (max)</td>
<td>2.75% (max)</td>
</tr>
<tr>
<td>Total acidity</td>
<td></td>
<td>2.0% (max)</td>
<td>2.0% (max)</td>
<td>2.0% (max)</td>
<td>2.0% (max)</td>
</tr>
<tr>
<td><strong>Edible flour</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisture</td>
<td>10% (max)</td>
<td>13% (max)</td>
<td>Non disponible</td>
<td>11-13%</td>
<td>13% (max)</td>
</tr>
<tr>
<td>Starch</td>
<td>65-70% (min)</td>
<td>2.5% (max)</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>Fiber</td>
<td>2% (max)</td>
<td>0.95% (max)</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cyanide</td>
<td>10mg/kg (max)</td>
<td>2.5% (max)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ash</td>
<td>0.6% (max)</td>
<td>0.95% (max)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total acidity</td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>