

BASIC PROCESSING SCIENCE WITH RESPECT TO
CASSAVA PROCESSING INTO GARI AND STANDARDS
AND QUALITY PARAMETERS OF GARI

LECTURES DELIVERED AT THE INTRODUCTION AND INSERVICE
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Cassava Tubers

The cassava tubers should be of big sizes, as the smaller tubers have much higher peeling losses. The smaller tubers also have much higher moisture contents and thus reduced yields of GARI.

The tubers should be freshly harvested and should not be more than 24 hours old. Old roots in addition to losing weight as a result of respiratory losses, also undergo physiological damage and microbial deterioration. The physiological damage occurs within 48 hours resulting in brown or dark necrosis, normally appearing as rings around the periphery of the cortex. Microbial deterioration begins with vascular streaking, then soft rot, fermentation of roots and finally the maceration of root tissues (CIAT, 1977).

Peeling

This should be done carefully to minimize peeling losses. It is also important to emphasize here that the bigger the tubers the less the peeling loss and the greater the yield of GARI.

For those cassava varieties with relatively loose peels, it will be better to split the peel along one side and pull off the peel by hand. For those varieties in which the peels do not pull off readily it will be faster to actually cut off the peels. However care should be taken in such cases not to cut deep into the flesh and at the same time not leaving any peels on the flesh. Residual peels will increase the cyanide content of the product and this is known to be toxic to human beings in high concentrations.

The peels will also increase the fibre content thus lowering the energy (nutritive) value of the final product.

Washing

This should be done thoroughly using as much water as the circumstances permit. This can be done in a large container or trough, and the washing water should be changed when it becomes opaque. (NB. Should not wait for the water to become dirty before changing).

It is important to note that splitting and pulling off the peels facilitates washing as cutting off the peels leaves rough surfaces which are difficult to wash.

Grating

The washed peeled tubers should be thoroughly drained before grating. The efficiency of grating (in terms of particle size) affects the quality and yield of the final product. The coarser the grater particles the greater the sieving (before roasting) loss and therefore the lesser the yield.

It is important that the grater used should be thoroughly cleaned with water at the end of usage to remove pockets of grated mash which would otherwise encourage microbial build-up and the subsequent contamination of the next batch. This can result in abnormal fermentation producing off - flavours in the final product.

Loading into Sacks

The sacks should be preferably woven mesh sacks of polypropylene as these are much stronger and easier to clean after usage than the jute sacks.

Pressing and Fermentation

This should preferably be carried out on a stand with perforated bottom to enable the exudate to be collected. The stand should be of iron bars and should be adequately painted with a black oil-based paint to prevent rusting. The use of wood is not advisable as this can easily rot, and this is in addition to causing contamination of the exudate, which will also need frequent changes.

Only the exudate from the initial pressing stages (within first few hours) when collected should be used for starch or tapioca production. This is because the subsequent exudates would have undergone some fermentation. The subsequent exudates can be mixed thoroughly with a freshly grated mash at a rate of 1kg liquor/50kg of grated mash before being loaded into the sacks. This will substantially reduce the fermentation period from about 60-72 hours to about 30-36 hrs.

The fermentation process is the all important step responsible for the distinctive flavour of gari. It is therefore essential that proper control is exercised over this step. The mash should be packed in clean sacks and the temperature and humidity should be ambient. The acidity of the mash at the end of fermentation should be about 0.70% (as lactic acid). This is usually indicated by the appearance of froths on the outside of the sacks.

Sieving

This is done to remove coarse particles and fibres from the fermented mash before roasting. The fermented mash at this stage should be dry enough to easily pass through the traditional sieves on the application of a moderate hand pressure.

Roasting/Frying

This is a crucial step which determines not only the consumer acceptance (quality) but also the keeping qualities of the end product. Good quality gari should be roasted to a slight yellow colour and should be dry and crisp to taste. Gari not roasted properly to this stage does not swell adequately in water, has short shelf-life and is generally not preferred by consumers.

Determining the end of the roasting process depends more on the experience and correct judgement of the processor. However it is important that the roasting be done slowly with constant stirring in large shallow metal pans and over a low fire, so that the gari does not char and the whole process controllable.

Sieving

This is again done over the traditional sieve. The coarse particles retained on the sieve can be rolled-milled and added back to the main batch. This ensures a more uniform product.

Packaging

The roasted gari should be thoroughly cooled before packaging to avoid moisture condensation which can be a source of spoilage. For retail packaging (ie. American tins) the measured quantities should be put in polythene bags and securely tied up at the top. This is more convenient and has better appeal to the consumer. Bulk packaging should be done in jute bags lined with polythene sheets and the top end sewed up.

The use of polythene bags in both cases is important to prevent the absorption of moisture by the gari thus enabling the gari to remain fresh and crisp for a long time. It also prevents mould growth on absorption of excessive moisture. It also prevents losses that might otherwise occur during transportation and prevents the entry of small creatures like insects and also of dust and other contaminants.

By-Product Utilization

- i. PEELS - The peels should preferably be washed initially in salt water before drying on raised platforms. They should be properly dried before being used as feedingstuff for sheep and goats. This will reduce the poisonous cyanide content and will therefore be less toxic to the animals.

- ii. EXUDATE - The exudate obtained initially, about the first few hours should be collected and pulled together in a large bowl, and should then be allowed to stand undisturbed for about 6 hours. The supernatant is drained off, and the residual starch washed thoroughly with clean water, filtered (passed through) a muslin cloth and again allowed to settle. This can be preferably washed a second time, settled and drained before being dried for starch or roasted for tapioca.

- iii. SIFTINGS BEFORE ROASTING
These should be spread thinly and dried in the sun. If too fibrous can be added to the dried peels as feedingstuff, otherwise should be milled and added to a kokonte batch.

STANDARDS AND QUALITY PARAMETERS OF GARI

QUALITY PARAMETERS (OF GARI)

- a. Should be dry and crisp.
- b. Should be light or creamy-yellow in colour.
- c. Should not be bland to taste but should have a slightly sour (acidic) and sharp taste, but without any peculiar odours.
- d. The particles should be of nearly uniform size.
- e. The product should be clear and should not contain stones, dirt particles, insects or their parts i.e. extraneous matter.
- f. Should preferably have a low fibre content.
- g. Should swell to about three times its volume when placed in water.
- h. Should have a low cyanide content.
- a. Should be dry and crisp

The attainment of this quality parameter depends on correctly judging the end-point of the roasting process, and though this depends largely on the correct judgement and experience of the processor, it is also affected by certain processing factors. It depends to some extent on the moisture content of the pressed cake and the temperature and length of roasting time. It is essential that the dewatering (or pressing) should be efficiently done by using appropriate weights for sufficient time. It is also essential to use a low fire for roasting to ensure that the gari is slowly brought to the desired end-point and the product is not charred by high temperatures. Continuous stirring of the product during roasting is also essential to prevent localised over-heating and charring of the products.

b. Should be light or creamy-yellow in colour

This is linked up with the dryness and crispness and is controlled by the same factors discussed above.

c. Should be slightly sour (acidic) and sharp to taste without any peculiar odour.

The typical taste of gari depends on the efficiency of the fermentation process. Too long a period of fermentation not only destroys the typical gari flavour but also results in undesirable off-flavours.

A short fermentation period does not allow for the development of the typical gari flavour. The fermentation (and pressing) should be for a minimum of 2½ days and should not be more than 5 days. Where an inoculum (third day exudate) is used the fermentation period can be reduced to 1-1½ days. It is however important to initially determine the period range necessary to produce an acceptable product.

d. Uniform particle size

This is largely controlled by the rasping surface of the grater. It is essential that the rasping surface should be evenly distributed, that there are no indentations on the surface and that there are no foreign matter, especially residue from previous operations on the rasping surface.

The uniformity of the particle size also depend on the type of sieve used both before and after roasting. The choice of sieve is therefore very important. The traditional bamboo mat sieves are adequate and the coarser particles retained on the sieve after roasting should be roller-milled and added to the bulk.

e. Cleanliness (Absence of Extraneous Matter) of the Product

Possible sources of dirt and contamination (i.e. extraneous matter) include unclean raspering surface (from previous use) of the grater, sieves, containers, roasting pan, packaging materials etc. It is therefore essential to ensure that all the equipment and utensils used are in a clean state.

Peeled tubers should be thoroughly washed before grating. The observance of good personal hygiene and cleanliness is very essential, and holds the key to a clean, wholesome product.

f. Low Fibre Content

High fibre content is invariably due to the usage of over-mature tubers. Under-mature tubers have much higher moisture contents and this results in low yields. It is therefore essential to use tubers of optimum maturity (9 to 12 months) depending on the variety. The sieving process before roasting helps to reduce the fibre content.

g. Swelling Capacity

This depends entirely on the observance of good manufacturing particles as already outlined and especially on the roasting process. The strict adherence to the processing schedules is therefore very essential. The increase in volume should be at least 300%.

h. Low Cyanide (Toxic Principle) content

There is known to be a toxic principle in raw cassava tubers called "Cyanide", and this is known to be more in the peels than in the flesh. It is however known that the various processing operations like peeling, grating, fermentation, drying and roasting all help to reduce the level of this substance to non-toxic levels, i.e. levels safe for human consumption.

Again it is essential that the various manufacturing practices outlined previously be carefully followed in order to reduce the content of this substance and render the final product safe for human consumption. The level of cyanide in the final product should not exceed 20ppm as HCN (Ingram, 1975).

References

1. Centro Internacional de Agricultura Tropical (CIAT)
"Cassava Program, 1977 Report".

2. Ingram, J.S. (1975)
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