



Survey of Technologies Used in Cassava Processing in Ikwerre Local Government Area of Rivers State

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Authors' contributions

This work was carried out in collaboration among all authors. Author NSA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author NSA managed the analyses of the study. Author UES managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The purpose of this study was to survey the technologies used in cassava processing in Ikwerre Local Government Area of Rivers State. Specifically, the study was proposed to determine the technologies used in harvesting, peeling, grinding, extracting water, sifting and frying crushed cassava tubers into Garri. A structured questionnaire titled "Survey of technologies used in cassava processing in Ikwerre Local Government Area of Rivers State (STUCP)". was administered to one hundred-fifty farmers in ten villages in Ikwerre Local Government Area of Rivers State, Nigeria. Data was analyzed with the use of pictorial view of the technology used in cassava processing and Statistical package for social science was used in determining the frequency, percentage and mean. The findings revealed that more need to be done in terms of the technology used in harvesting, peeling, grinding, extracting water, sifting and frying crushed cassava tubers into Garri. One of the recommendations was that technology used in cassava processing should be improved in order to boost garri production in Rivers State.

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1. INTRODUCTION

Cassava is the third most important food source in the tropics after rice and maize and is the staple food of at least 500 million people [1]. Cassava is easy to grow, yields well in good conditions and even in poor soils subject to dry conditions it still produces edible roots. The roots are very starchy and the young leaves are a good source of protein [2]. Because of the perceived agricultural advantages of growing cassava and increasing population pressures its usage is being extended to regions in Africa and elsewhere in which it was not formerly used. Nigeria produces more than half of total world cassava. But most of the cassava is traditionally consumed by processing the fresh roots into gari, fufu, and flour [3].

The consumer need for garri production in Ikwerre Local Government Area of Rivers State was the burning desire for the researcher to focus on the technology used in harvesting, peeling, grinding, extracting water, sifting and frying crushed cassava tubers into garri. In Ikwerre, the cassava tuber can be processed into garri, fufu, tapioka and cassava grit for direct, humid tropics and it is capable of providing very high yields of energy per hectare, for example about thirteen times more than maize or guinea corn [4] Cassava is a major source of carbohydrate in most developing nations.

In 2004, a policy was initiated to produce bread using cassava and wheat flour at a ratio of 1.9 in the Nigerian bakery industry. It's on record that with the enhancement of technology more will be done in garri production. Apart from human consumption, cassava is also used for animal feed and alcohol production [5]. China is demanding enormous quantities of cassava from the Nigerian market and more industries potential of cassava are being discovered by the day. For instance, India has succeeded in substituting petrol with 40% ethanol while Congo has attained 30% inclusion of cassava flour in the production of bread [6].

1.1 Technologies in Cassava Processing

Technology could be generally described as the sum total of techniques, skills, methods, and processes used in the production of goods or services or in the accomplishment of objectives, such as scientific investigation. Technology can

also be seen as the process of by which humans modify nature to meet their needs and wants. According to Olayide [7] defined technology as the systematic application and collective human rationality to the solution of the problems through the assertion of control over nature and all kinds of human processes. Technologies are technical skills or instrument used in carrying out an operation that could be tedious for manual operation. For instance processing involves transformation and preservation through physical or chemical alteration, storage, packaging and distribution [8]. Processing of agricultural produce requires both human and machine effort because of its complexity. According to Adiaha [9] observed that processing in agriculture involves the biological, physical, mechanical, and biochemical manipulation of agricultural produce in other to preserve it for further use. It involves the series of operations taken to change agricultural products into a consumer-finish product.

International institute of tropical agriculture [10] noted that due to the cyanide content of cassava root, they are required to be processed before consumption and lacks the potential to remain stored for a long period of time. Ndaliman [11], supported that that the toxicity and perishability of cassava root makes it compulsory for processing within four hours to forty-eight hours of harvesting to avoid post harvest losses. Physiological changes occurs very rapidly in cassava roots after harvesting due to high moisture content which leads to rot and decay. Cassava roots therefore are to be processed immediately after harvesting to reduce the tendency of food wastage [12] noted that the unit operations involved in cassava processing include harvesting, peeling, grating, de-watering or extracting water, sieving and frying. However, the manual operation of these processes is time consuming and very tiresome to carry out. It required the used of various technologies in each of the unit operations for reduced human efforts.

1.2 Harvesting of Cassava

Cassava is harvested throughout the year when the roots reach maturity at 12 months. But maturity differs from one variety to another. In regions with seasonal rains, like Ikwerre in Rivers State, harvesting is usually done in both dry and raining season. Harvesting is still a manual operation in Ikwerre in Rivers State. Equipment

to use in facilitating the harvesting process is what the farmers are looking forward to. Presently farmers are using machete and hoe in harvesting in Ikwere. During harvesting, the cassava stalks are cut off 40-60 cm above ground by hand with the use of machete. This length of stalk is left as a handle for pulling. In light soils the cassava stalks are pulled the tubers are cut off the stock. In heavier soils a hoe may be required to dig up the roots before the plant is pulled out. Once the roots are harvested, they begin to deteriorate within about 48 hours, initially owing to enzymatic changes in the roots and then to rot and decay. The roots may be kept refrigerated for up to a week. They may be stored in the ground for longer periods if they are not detached from the plant. According to FAO [13] report says that poor processing is a major cause of post-harvest losses in the world with special emphasis on developing countries such as Nigeria. Traditionally, cassava is harvested by hand, lifting the lower part of the stem and pulling the roots or tubers out from the ground, then removing the tubers from the base of the plant by hand. On a strong or hard soil the use of machete/hoe is needed to dig carefully round the plant before pulling. The upper parts of the stems with the leaves are removed before harvesting takes place. It is usually during the harvesting process that stem cutting for the next planting are selected.

1.3 Peeling of Cassava

Cassava must be peeled to remove the inedible parts of the tuber consisting of the most toxic Cyanogenic glycosides, the ratio of glycosides

compared to the starchy flow varying below 5-10:1. In Ikwere Local Government, peeling is usually done manually by hand using knife. Varieties which are easy to peel, the peel is slit along the length of one side of the tuber and the knife and fingers are used to roll back the peels from the fleshy portion of the tuber. In varieties which are difficult to peel, the two layers of peel are whittled with a knife in a motion reminiscent of sharpening pencil. However, hand peeling is slow and labour demanding but at the end the product is the best for consumption. Nweke et al. [14] reported that one way to make Cassava production, processing and export a reality is to identify any cassava harvesting or peeling machine designed for smallholders anywhere in the world and to urgently put such to on-farm test in Africa with a view to adapt, fabricate, and diffuse it to farmers. The rate could be as high as 350 kg/day of 8 hours/person (Igbeka Jory, Griffon, [15]).

1.4 Grating of Cassava

Initially grating was done manually. It is the most tedious and painful operation of the whole process. The manual grater is a piece of galvanized metal shut or a piece of flattened can or tin punched with about 3 mm diameter nails leaving a raised jagged flange on the underside.

However, the use of mechanized grating is now used in Ikwere land. Sometimes a group of processors will purchase their own mechanically powered rasping (grating machine) or an individual will move within a group of village grating cassava for a fee. Grater uses an



Fig. 1. Pictorial view of harvesting of cassava



Fig. 2. Pictorial view of indigenous technology used for cassava peeling



Fig. 3. Pictorial view of indigenous technology used in cassava grating

abrasive disc. The abrasive surface can be either cylindrical or a flat disc attached to a wooden frame. The grater surface normally wears out and the group or individual most replace it otherwise the output of the machine will be reduced. The abrasive disc is washed clean after use for the day. There are so many kinds of graters / grinding machines used in Ikwerre Local Government Area, these include manual greater, small engine grater, locally fabricated hand driven grating machine, stationary mechanized grating machine.

1.5 Extracting of Water (Starch)

In Ikwerre land, extracting of water or pressing (de-watering) are done traditionally. This is otherwise known as the process of fermentation of cassava.

The grated mash is packed inside a weaving perforated sack and then put under pressure by laying it on two (2) sticks and using another 2 sticks on top tightening the sticks together with the use of two ropes, each per pair of stick

and 2 chairs holding the other side of the stick. During dewatering some soluble cyanide and organic acid is removed with the press liquor it also contains some starch and may be used as a base for stews and soup or the starch can be recovered by allowing the liquor to settle and decanting off the liquid. De watering process has been improved as processing is now done using one of a number of design of screw or hydraulic press which need access to simple workshops for their construction. This technology has a parallel board press in which a pulp filled bag is placed between two parallel boards which are screwed together to apply pressure to the bag. It has also been

extended to a screw press which can take several bags.

1.6 Sieving of Cassava

Sieving is done after pressing or de watering has taken up to 2-4 days depending on varieties of cassava. The de-watering cassava mash is a solid cake which has to be broken up into piece and several to remove the large lumps and fibre and to obtain a homogenous product. Sieving is done traditionally in Ikwerre land with the use of weaving tray raffia palm or bamboo. The sieving operation is not very difficult or tedious compared to other operations in cassava processing.



Fig. 4 (a & b). Pictorial view of extracting of water



Fig. 5. Pictorial view of indigenous technology used in sieving cassava



Fig. 6. (a &b). Pictorial view of indigenous technology used in cassava frying

1.7 Frying of Cassava

The sifted cake is thereby toasted and stirred 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 20-30 mins depending on the heat source and quantity of sifted cake.

There are myriads of challenges that people of Ikwerre local government in Rivers State Nigeria face in utilizing these indigenous technologies for cassava processing. Based on the fact that processed cassava is a very common food for the Ikwerre people, therefore they consistently undergo the rigorous activities involved cassava processing through the identified indigenous technologies. There are harms caused to cassava processors for instance during peeling there may be cut or hazard, extraction of water

requires the efforts of two or more person and also the frying process is extremely rigorous as it involves the use of local firewood which causes a lot of smoke. Based on these and many more constraint associated with local indigenous technology usage, there is need for invention of department of agriculture within and outside the state to swing in to developing a more sophisticated technology for processing and extending them to the local indigenes for proper utilization.

2. METHODOLOGY

The study adopted descriptive survey research design. The study adopted accidental sampling techniques to select 150 cassava growers in Ikwerre local government area. The instrument used for the study was a structured questionnaire titled "Survey of technologies used in cassava

processing in Ikwerre Local Government Area of Rivers State (STUCP)". The instrument was faced and content validated by two experts in the department of vocational and technology education Rivers State University. The reliability of the instrument was established using Cronbach Alpha coefficient. The reliability coefficient obtained was 0.72 which was

Table 1. Frequency and percentage of indigenous technologies involved in processing cassava in Ikwerre local Government Area Rivers State

Technology used in processing cassava	Frequency of respondents	Percentage of respondents
Harvesting		
1. Hoe	148	98.7%
2. Machete	126	84%
3. Shovel	65	43%
4. Digger	90	60%
5. Cassava Lifter	41	53%
	20	13%
Peeling		
1. Kitchen knife	100	67%
2. Machete	70	47%
3. Basin	89	59%
4. Water	90	60%
5. Locally fabricated peeling machine	65	43%
Grinding		
1. Small Engine Grater	95	63%
2. Manual grater	120	80%
3. Hand grating and stone pressing	90	60%
4. Hand grating and wood pressing	90	60%
3. Mechanized grinder	80	53%
4. Mechanical grating and hydraulic pressing machine	45	30%
Extracting Water		
1. Four strong three feet sticks	98	65%
2. Four strong three feet ropes	87	58%
3. Empty fifty Kg rice bag	90	60%
4. Hydraulic press	120	80%
5. Combine grater and water extracting machine.	45	30%
Sifting		
1. Perforated flat rafter tray	99	66%
2. Plastic perforated filter	65	43%
3. Mechanical sifting machine	30	20%
4. Combined sifting and fryer	25	16%
Frying		
1. Cassava frying pot with T-stick on heap of diameter mound and firewood	98	65%
2. Cassava frying pot with spatula on heap of diameter mound & firewood	120	80%
3. Fabricated iron frying pot with T-stick	30	20%
4. Combined drying and frying machine	20	13%
5. Gas fryer (fabricated locally)	20	13%
6. Electric fryer (fabricated locally)	20	13%
Packaging and Storing		
Polythene Bags	52	
Basin	76	
Perforated Sacks	100	100%
Rice Bags	81	

N=150; Multiple response

considered reliable. The instrument was administered to the researchers and the other assistants. When needed the pictures of the technologies enlisted in the questionnaire was shown to the respondents to enhance proper identification. Data was analyzed with the frequency and percentages.

3. RESULTS

The Table 1 shows the responses of cassava farmers on the indigenous technologies in each of the stages in cassava processing. In harvesting of cassava, 98.7% use hoe, 84% use machete, 43% use digger, only 2% use cassava lifter. Also, in cassava peeling, respondents indicated that Kitchen Knife (100%), Matchete (47%), 3% use peeling tool, 2% use Proda peeler and 2% use action-zone peeler. More so, in cassava grinding 95% indicated small engine grater, 80% use manual grater, while 53% use mobile mechanized grinder and 30% use combined grater and water extractor machine.

Based on the responses, technologies involved in extracting water (Dewatering) in Ikwerre Local government Area are four strong three feet sticks (98%), Four strong three feet ropes (87%), Empty sack bag (60%) and hydraulic presser (80%). In sifting, respondents indicated that perforated flat rafter tray (66%), plastic perforated bowl-like filters (43%), mechanized sifting machine (20%) and combined sifting and frying machine (16%). Lastly, the respondents shows that cassava frying is done using Cassava frying pot with T-stick on heap of diameter mound and firewood (65%), the use of Cassava frying pot with spatula on heap of diameter mound and firewood (80%). Fabricated iron frying pot with T-stick (20%) Combined drying and frying machine (13%) Gas fryer (fabricated locally) (13%) Electric fryer (fabricated locally) (13%). In packaging and storing, the respondents showed that perforated sacks (100%), basin (76%), rice bags (81%) and poly-ethene bags (52%).

4. DISCUSSION OF FINDINGS

The findings revealed that more need to be done in terms of the technology used in harvesting, peeling, grinding, extracting water, sifting and frying crushed cassava tubers into Garri. It also showed that farmers in Ikwerre local government area of Rivers State used mostly traditional methods for their post harvest operations and although most of them have the knowledge of the

existence of improved technologies for the said operations but they are yet to be exposed or see those technologies mostly because of lack of fund and poor information and this is in agreement with Nweke [14] who reported that one way to make Cassava production, processing and export a reality is to identify any cassava harvesting or peeling machine designed for smallholders anywhere in the world and to urgently put such to on-farm test in Africa with a view to adapt, fabricate, and diffuse it to farmers.

5. CONCLUSION

In conclusion, greater percentage of the respondents agreed to the use of traditional method of post harvest operations of harvesting, peeling, washing, grating, dewatering, sifting and frying while few of an average of 20% said they did not even have knowledge of the existence of other technologies outside the ones they were used to.

6. RECOMMENDATION

The study recommended that

- Other advanced technology for cassava processing should be extended to the rural areas in order to boost Garri production in Rivers State.
- Government should ensure that literate and non-literate farmers in Rivers state are efficiently trained in the use of cassava processing machines that could improve their production process.
- Agricultural machinery companies should work towards the commercialization of viable cassava processing machinery.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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