Characteristics of Various Cassava Processing Methods and the Adoption Requirements in Ghana

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Characteristics of Various Cassava Processing Methods and the Adoption Requirements in Ghana

Wilhemina Quaye, J. Gayin, I. Yawson and W.A. Plahar
Food Research Institute, Socioeconomic Department
P. Box M20, Accra, Ghana
Corresponding author: Wilhemina Quaye, e-mail: quayewilhemina@yahoo.com

Abstract
A survey was conducted in some selected cassava growing districts in Ghana to identify, characterize and describe the various cassava processing methods. The survey also sought to determine the adoption requirements for various improved processing approaches. These improved processing approaches included the use of improved graters and pressers for the production of gari (a roasted fermented cassava meal) and agbelima (fermented cassava mash), the use of improved stoves for gari production as well as high quality cassava flour (HQCF) production. Using free listing technique, respondents expressed what they perceived as adoption requirements for each improved technology. With the exception of the improved stoves, adoption requirements for cassava processing technologies at the small scale level were similar in all the surveyed districts. Affordability, efficiency of equipment, labour use and local capacity for repairs and maintenance were some of the considerations made for adopting an improved cassava processing technology.

Keywords: Cassava, processing, technologies, adoption, Ghana

Introduction
Cassava (Manihot esculenta) is an important food crop in the tropics and is a major carbohydrate staple. According to FAO, cassava is the third most important source of calories in the tropics, after rice and corn (FAO, 2002). The use of cassava as a source of ethanol for fuel, energy in animal feed, and starch for industry is increasing (Kolawole and Agbetoye, 2007; Kehinde, 2006). As a food crop, cassava is grown in all the agro-ecological zones of Ghana (Graffham et al., 1998). Fresh cassava does not store well because of its high moisture content. Therefore cassava is usually processed traditionally to obtain different relatively shelf stable intermediate and final products for various food applications. These products include “gari”, a roasted fermented cassava meal, “agbelima” which is a fermented cassava mash and the dried cassava chips known as “kokonte” which is further processed into cassava flour. Tapioca is a minor product or by-product from cassava processing. For industrial use, cassava is processed to obtain starch. Village level agro-processing activities are responsible for the preservation and distribution of the bulk of Ghana’s agricultural produce, playing a major role in the post harvest food system. These activities constitute the main occupation of rural women (IFAD, 2007) who employ age-old traditional techniques in the processing of root and tuber crops. Traditional methods employed are simple and convenient for their scale of production. The equipment used for the traditional processes are cheaper compared to the requirements for modern high technology processes. However, these traditional technologies are low yielding, time consuming, labour intensive and give products of relatively low quality (Scott et al., 2002; Westby, 2002; Dziedzoave et al., 1999; Oduro and Clarke, 1999).

In Ghana, the Ministry of Food and Agriculture (MOFA) under the International Fund for Agricultural Development (IFAD) implemented Root and Tuber Improvement Programme (RTIP) which aimed at enhancing food security and increasing incomes of resource-poor farmers. This was done through access to new but locally proven adapted technologies for root and tuber crops including cassava, cocoyam, sweet potatoes, and yam. Through the
activities of RTIP, the number of adopting farmers of improved cassava technologies increased from 33,294 to 343,949 between 2001 and 2003 (RTIP Interim Evaluation Report, 2004). This resulted in excess cassava supply in some parts of the country, with its attendant drop in cassava prices since 2001. The interim evaluation of RTIP attributed excess cassava supply to the low focus on programme design and, on the implementation of post-production issues especially processing. Main cassava processing technologies transferred under RTIP were those involving the use of improved graters and presses for the production of gari (a roasted fermented cassava meal) and agbelina (a fermented cassava mash), the use of improved stoves (Appiah et al., 2003) for the production of gari and the production of high quality cassava flour (HQCF) (Dziedzoave et al., 2003). As part of project evaluation process, there was the need to assess the adoption requirements for these cassava processing methods. Specifically this study sought to address the following:

i. Identify, characterize and describe for each processed cassava product the various approaches used for processing

ii. Determine the adoption requirements for each approach

Methodology

Rural Participatory Appraisal (PRA) techniques (Chambers, 1992) was employed in addressing the objectives of this study. Regarding the PRA, a semi-structured questionnaire/checklist addressing the issues raised in the objectives was used to gather informal qualitative data and information in a more interactive manner. Primarily, the PRA involved individual interviews with key informants, focus group discussions (Borgatti, 1999) with processors and personal observations. Participants were first asked to free list what they perceive as adoption requirement (as the domain for free listing; Quinlan, 2005), and then later the list was pooled for further group discussions on emerging patterns.

A sample size of 100 cassava processors consisting of 90 small-scale processors in three districts of Ghana were covered; 30 each in Suhum-Krabo-Coaltar, Awutu-Efutu-Senya, and Ho Districts, and 10 small and large-scale processors in the Ga District. A purposive sampling procedure was followed by first identifying the

Characteristics of the various processing approaches

Existing Processing Technologies

Production of Gari

Gari was the most popular processed cassava product in all the surveyed districts. Traditional production of gari from fresh cassava involved the unit operations of peeling, washing, grating, pressing and fermentation, sieving and roasting. Traditionally, peeling of cassava roots was achieved manually with sharp knives. The peels were dried for animal feed. The peeled roots were washed thoroughly and grated by rubbing on the rough surface of a perforated galvanized metal sheet fixed to a wooden board support. The grated cassava mash was packed into jute bags and the open ends tied securely with rope. The loaded bags were then packed on wooden racks and heavy stones placed on them to press out the starchy juice. This was followed by the fermentation process for a period of about
two days. The pressed fermented dough was dried in the sun and sieved by rubbing on a raffia sieve tray to remove roughage. The sieved grains were roasted over fire in open cast iron frying pan with brisk stirring until cooked and crisp. The roasted mass was again sieved to remove lumps, and packaged for storage and marketing. Diagrammatic presentation of the process is shown in Fig. 1.

**Production of Agbelima**

For the traditional production of fermented cassava dough (*agbelima*), grated cassava mash was pressed for 2 - 4 days as described earlier. This pressing and fermentation enhance the keeping properties of the dough but only for a few days. The fermented dough was used for the preparation of Ghanaian dishes like ‘Akple’ and ‘Yakeyake’. The process is shown in Fig. 2.

**Production of kokonte**

The traditional production of “kokonte” was a simple process in which peeled roots were cut into small pieces and dried in the sun for 4 - 6 days; the smaller the pieces, the shorter the drying period. Fermentation took place during drying, and this imparted desirable aroma to the dried product. It was reported that if the sun-drying operation proceeded too slowly, mould growth was promoted and dark brown or greenish black product resulted. The dried product could be stored for several weeks as whole chips. This intermediate product was milled into flour and used in the preparation of a cooked traditional meal and eaten with soup or stew. The flow diagram is shown in Fig. 3.

**Production of cassava chips**

Production of cassava chips from fresh cassava involved the unit operations of peeling, washing, slicing, drying, cooling and packaging. Cassava roots were peeled manually with sharp knives and washed. Afterwards, peeled and washed cassava was thinly sliced to facilitate drying. The dried product was cooled and packaged as an intermediate product milled into flour and used in other food applications. Diagrammatic presentation of cassava chips production is shown in Fig. 4.

**Production of starch and tapioca**

Production of starch and tapioca involved a washing step before peeling apparently to get rid of impurities (mud) which might impart undesirable color to the final product.
Cassava was manually peeled and thoroughly washed. This was followed by grating into fine pulp. The pulp was then washed over a strainer so that coarse particles could be reintroduced into the grater. Unit operations involving sedimentation, drying at 55°C, milling and sifting, and packaging followed in that order (Fig. 5).

To obtain tapioca, water was added to the sediment and decanted. The surface of the sediment was washed, pressed and partially dried for 2-3 hours. Other unit operations that followed include sieving and roasting, drying and winnowing.

**General unit operations involved in cassava processing**

**Peeling**

Cassava must be peeled to remove the inedible outer parts of the root consisting of the corky periderm and the cortex which are known to contain most of the toxic cyanogenic glucosides. At the village level, peeling was usually done manually using a knife. In varieties which were easy to peel, the peel was slit along the length of one side of the root and the knife-blade and fingers used to roll back the peels from the fleshy portion of the root. Hand peeling was slow and labour intensive but yielded the best results.

**Chipping/slicing**

The objective of chipping was to expose the maximum surface (i.e. increase surface area) of the starchy flesh and encourage a rapid drying. Processors had learned that the best drying, in terms of quickness and quality of the end product was with thin slices. Thick slices were difficult to dry because the rate of moisture diffusion from the inside was greatly reduced and the time for complete drying considerably extended. Usually in sun-drying systems the chips are dried more by the passage of air over them than by the direct effects of the sun’s rays. For effective drying the chip’s shape should permit air to readily pass through a large mass of chips.

**Fermentation and de-watering**

In the traditional operations fermentation and pressing (de-watering) were done in one operation. The grated mash was transferred into baskets, jute bags or perforated plastic sacks and left to ferment for 1-4 days. The duration of the operation affected the colour, taste and texture of the product. This duration could be reduced by seeding the freshly grated mash with previously fermented liquor as a starter, but there must be thorough mixing. During the fermentation period the container was put under pressure by piling heavy stones on it, by strongly twisting the neck of the sacks and pressing the bag or sack between wooden poles tightened by ropes. In the latter cases the
bag or sack was re-tightened every day as the liquor flew out of the cassava mash.

In larger scale operations, pressing took place after fermentation. The grated mash was left to ferment for one to four days in its container. Pressing was done using one of a number of designs of screw or hydraulic press. The Technology Consultancy Centre in Ghana developed a parallel board press in which a pulp filled bag was placed between two parallel boards which were screwed together to apply pressure to the bag. This idea had been extended to a screw press which took several bags, but its construction required heavy metal components.

Sieving

After pressing, the de-watered cassava mash (a solid cake) had to be broken up and sieved to remove the large lumps and fibre (from the central vascular strands) and to obtain a homogenous product. Uniform particle size was important for product quality (because for instance it allowed for a more uniform roasting of individual particles during the frying operation since smaller particles took less time and less energy in roasting). Traditionally sieving was done manually using sieves made from palm leaves, bamboo or raffia cane. The sieving operation was not very difficult or arduous compared to some of the other processing operations. Mechanical sieves were used even in small commercial operations. Sieves were single or double screen trays which oscillate by means of an eccentric cam driven by small electric motor or powered by some means from the engine driving the plant.

Drying

Sun-drying of cassava chips was carried out on any convenient flat surface; on roofs, concrete surfaces or mats. The objective was to produce dry cassava chips which were clean, white colour and free from extraneous matter that with longer shelf life. Many factors such as thickness of the slices, the loading rate, i.e. quantity of chips per unit area of drying surface, air temperature and relative humidity and wind speed affected the rate of drying of cassava chips.

Grating

Traditionally grating operation was carried out manually. However at the time of the survey, power-operated graters of various makes and models were widely used. Hand grating was a tedious operation. The cassava was grated at least one hour after washing to allow drainage of excess water off the peeled and washed cassava. This was because the roots were normally too slippery and very difficult to hold during grating. The manual grater was only a piece of galvanized metal sheet or a piece of flattened can or tin, punched with about 3mm diameter nails leaving a raised jagged flange on the underside. This grating surface was fixed on a wooden frame and the cassava pieces pressed against the jagged side of the metal and rubbed vigorously with strong downward movements. It was not possible to completely grate a whole cassava piece, 3% to 5% of the cassava had to be left un-grated. A skilful person was able to produce only about 20 kg/hour.

Frying/Roasting and drying

Roasting and drying were combined in the “frying” of the gari. At village level, gari was fried in shallow cast-iron pans, or in the more traditional areas in earthenware pans, over an open wood fire. The sieved cassava mash was spread thinly in the pan in 2-3kg batches. A piece of calabash was often used to press the mash against the hot surface of the pan but scraped quickly and stirred constantly to keep the material moving to prevent it from burning until frying was completed when it reaches a temperature of 80° to 85°C. The rapid heating partially gelatinizes the gari which was dried during the operation of frying. The process took 30-35 minutes, with the moisture content of the final product reduced to about 18%.

Gari frying, a complex procedure in traditional processing, depended almost entirely on the skill of the operator. Simply stirring the cassava mash over a fire could yield a product which may look like gari but will not be acceptable to consumers. Assessing the point at which the grains were completely gelatinized and the frying complete was a very subjective judgment and depended on the experience and skill of the operator. Experienced gari processors knew when roasting was complete simply by the appearance of the particles and by the feel of the texture whilst stirring.

A traditional fireplace consisted of three large stones supporting the frying pan. This caused a great deal of discomfort to the operators due to exposure to heat and smoke from the fire and steam from the wet cassava mash. At the same time the system was very inefficient in its use of fuel as energy consumption per unit of dried gari
was considered to be very high. Enclosing the fire on three sides improved fuel consumption and reduced the smoke blowing into the faces of the operator. The inefficiency of frying and firewood consumption was the most important issues in traditional *gari* production.

At the time of this survey, a lot of efforts were being made to upgrade the traditional techniques through the introduction of more convenient equipment and machinery for certain unit operations in Ghana. Women processors were trained through demonstrations on improved food processing techniques and the basic principles of nutrition and food preservation. However, proper coordination and comprehensive appraisal of the financial and economic feasibility of the village level agro-processing activities are needed for effective adaptation and adoption of the improved technologies.

**Mechanization of unit operations**

Mechanization of key unit operations in the traditional processing of cassava constituted the improved technique being promoted. The promotion and adoption of the mechanized operations were aimed at reducing drudgery, enhancing process efficiency and avoiding the hazards associated with the traditional techniques. With the exception of peeling which was still done manually, all the other operations had been mechanized. Adoption of the mechanized operations in a process depended to a large extent on the scale of production. Spray washers and rotating drum washers were being introduced to replace manual washing. This system was very beneficial in large scale cassava processing. However, small scale producers could conveniently use manual washing to avoid the extra cost. The use of mechanized graters was highly beneficial to both small-scale and large-scale processors.

In the case of small-scale individual cassava processors, it was not necessary to purchase the grating equipment as part of the capital input. It was usually available as service for a fee. Available mechanized graters included the cylindrical grater and the disc grater. The cylindrical or drum graters were operated by diesel engines or electric motors. With the high speed of operation, production capacity was about 500 Kg hr⁻¹. The disc grater was also driven by diesel engine and had an output capacity of 200 Kg hr⁻¹. Various presses available on the market at the time of the study included the parallel board press, the screw press and the hydraulic press. The parallel board press and the screw press were easily adopted by village group processors. For sieving the de-watered cassava dough before roasting a rotating drum sieve power operated with a diesel engine or electric motor was used. Roasting could also be achieved by the use of cylindrical rotating drum roasters fitted with mechanical stirrers. The drum was heated at the bottom by use of fuel.

**Improved technologies**

Technologies for root and tuber crop processing developed by the Food Research Institute, which were ready for transfer and commercialization for enhanced food security included dehydrated products such as fermented cassava meals, cassava chips and flours. These are intermediate products for the preparation of various traditional foods and developed recipes. In addition, convenience foods such as *fufu* (ground root and tuber crops) powders had been developed to facilitate the preparation of *fufu* in urban homes without the requirement for the highly perishable fresh root and tuber crops. Other cassava based products included high protein *gari* prepared from cassava and *soybean* with proper packaging for sale in supermarkets in urban centres.

The high quality cassava flour or HQCF was the most recent research output of the Food Research Institute in cassava processing but popular due to the versatility of its application as an industrial raw material. This intermediate cassava flour could be used for adhesives in the plywood industry, for the formulation of composite flours in the bakery industry, and for the production of cassava glucose syrup for use in the confectionery industry (Fig. 6).

**Technologies transferred under RTIP**

As discussed under the introductory chapter, the root and tuber improvement programme so had been very effective in terms of production but the same could not be said for processing. Main processing technologies considered were those involving the use of improved graters and presses for the production of *Gari* and *Agbelima*, the use of improved stoves for the production of *Gari* and the production of High quality cassava flour (HQCF). The processing techniques however, were not different from the description for already existing ones detailed above. Table 1 provides information on the cassava processing technologies transferred under RTIP in the various districts surveyed.
Results and Discussion

Adoption requirement

Numerous theories have been advanced by social scientists and other disciplines to explain and measure technology or innovation adoption (Feder et al., 1982; Rogers, 1995; Doss, 2003). Much of the literatures on adoption of innovations/improved technologies focus on the long-term rate of adoption, which is usually represented by an S-shaped cumulative frequency curve and the factors that influence the adoption decisions. Usually, a distinction is made between the degree of use (intensity of adoption) and incidence/level of adoption of an improved technology. The present study examined the adoption requirement of the various cassava processing technologies transferred under RTIP programme through interactions with processors and descriptive information/data presented without the use of econometric models. Thus there is very little econometric information on intensity of use (the intensity of adoption referring to the extent of use of a technology/innovation by the adoption unit once the decision to adopt has been made) and level of utilization of the cassava processing technologies (referring to the situation where the adopting unit has used or not used them).

Table 1. Improved cassava processing technologies transferred under RTIP in the surveyed districts

<table>
<thead>
<tr>
<th>District</th>
<th>Location</th>
<th>Cassava processing methods</th>
<th>Product</th>
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<tbody>
<tr>
<td>Ho</td>
<td>Bankoe</td>
<td>HQCF technology</td>
<td>Gari</td>
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<td></td>
<td>Akrofu-Xeviefe</td>
<td>Improved Stoves</td>
<td>Agbelima</td>
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<td>Tangibe Atidze</td>
<td>Improved press and grater</td>
<td>Cassava grits (for Amasa)</td>
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<td>Tangibe Etoe</td>
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<td>Suhum Krabo Coaltar</td>
<td>Suhum</td>
<td>HQCF technology</td>
<td>Gari</td>
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<td></td>
<td>Amanase</td>
<td>Improved Stoves</td>
<td>Agbelima</td>
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<td></td>
<td>Krabokese</td>
<td>Improved press and grater</td>
<td>Kokonte (By product from Gari production)</td>
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<td>Awutu Efutu Senya</td>
<td>Ayeresu</td>
<td>HQCF technology</td>
<td>Gari</td>
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<td>Bontrease</td>
<td>Improved Stoves</td>
<td>Agbelima</td>
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<td>Bawjiase</td>
<td>Improved press and grater</td>
<td>HQCF (Demonstrations)</td>
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<td>Kokonte frm Gari production</td>
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<td>HQCF technology</td>
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<td>Improved Stoves</td>
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<td>Amasa Processing factory</td>
<td>Improved press and grater</td>
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<td>Gari, Kokonte</td>
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the technology/innovation during a reference period) in this paper. Technologies studied were those involving:

i. The use of improved graters and presses for the production of Gari and Agbelima

ii. The use of improved stoves for the production of Gari

iii. The production of HQCF

Adoption requirements for improved graters and presses

With the exception of improved stoves, adoption requirements of the cassava processing technologies at the small scale level were similar in all the surveyed districts. The issue of affordability was critical to the acquisition of an improved grater or press. In a typical village level situation, improved grater and/or press was privately owned, with processors using the facilities on a service charge basis. Where an improved grater and/or press were given to processing groups or communities, adoption decision was made along the following considerations viz., efficiency of equipment, cost effectiveness/implications on profit margins, adequacy of number of equipment especially with the use of cassava dough press, labour requirements, local capacity for repair & maintenance and site location.

For instance, in Suhum Kraboa Coaltar District, processors complained about the inefficiency of graters provided under RTIP as compared to the private ones in the localities. Blade sets were blunt and did not give smooth product. Some processors who had discontinued using the facilities provided complained of the pressure on the screw press as well as the labour intensiveness associated with its use. Another issue that was revealed about the screw press was about its short fermentation duration. This though desirable in terms of enhancing productivity, had an element of dissatisfaction. Short fermentation duration causes Gari to be too sweet. Experienced processors had the opinion that Gari should be moderately bitter. Considering the fact that most small scale cassava processors look for areas of cost savings in the processing activities, few processors still used the traditional stone pressing method. For Agbelima processors in Awutu Efutu Senya District, ‘tread and tie’ press was equally efficient and would not bother with any improved press. Screw press broke down frequently and needed further improvement.

Improved cassava processing equipment was usually abandoned when not functioning properly due to lack of local capacity for repairs and maintenance. Thus the slightest challenge became a scare crow. Sometimes, instead of looking for solutions, beneficiaries rather looked out for alternative uses even if it took adopters back to old methods. Therefore, for effective adoption of an improved cassava processing technologies, local capacity need to be developed in the area of repairs and maintenance. In the Ho district, location of site of improved cassava processing unit was crucial to adoption. Some processors were still using manual grating and stone pressing method due proximity – location of improved equipments were beyond their reach.

Adoption requirements for improved stoves

With regard to adoption of improved stoves the issues considered were fuel efficiency of stove design (should be fuel efficient), location (well located taken into consideration the direction of the wind), shed to house improved stoves, labour requirement (less labour requirement) and repairs and maintenance (easy to maintain using locally available material).

With improved stoves there were cases of disadoption primarily due to lack of shed to house the improved stoves. Other factors associated with disadoption included long roasting periods and supposedly high fuel use. These complaints came up during interactions with some processors in Suhum-Kraboa-Coaltar district, who had had the chance of using bricks made smokeless stoves that were not properly shed.

In Awutu- Efutu-Senya district, adoption rate of improved stoves was variable. Processing units were constructed in selected operational areas using community labour. The processors also had to organize clay for the stove construction as well as materials for shed. Unfortunately, some communities were unable to provide durable material for sheds. Such stoves did not last long. Interestingly, smokeless stove technology transfer had caught up well in some communities. Individuals who could afford to have their own stoves had studied the demonstration stove and adopted with modifications to improve on the fuel efficiency, heat radiation and smoke emission. Some respondents complained of smoky nature of the improved stoves, and suggested the need for further improvement.
Again the problem of lack of funds to construct shed came up in Ho District but the main problem in this area was the inappropriate location of community owned processing sites. Intended beneficiaries were not patronizing because the location of processing units were far from processors. Disadoption is one important aspect which has not been given due consideration in past adoption studies. Information on why some processors discontinue using recommended technology raises thought provoking issues that are relevant for future roll out / dissemination programs on the improved technology. Thus addressing the issue of well constructed shed to house improved stove technology would help improve upon the chances of acceptability and wider dissemination of the technology among the intended beneficiaries.

The issue of cost savings on fuel associated with improved stoves received mixed reactions. While majority of processors interviewed in the Suhum-Kraboa-Coaltar District were silent on fuel efficiency some respondents in Awutu Efutu Senya District presented a strong arguments to support this assertion. A practical research into this would be useful. Conservation of energy and reduction of smoke emissions were affected by the direction of the wind. Based on experience with demonstration stoves in Awutu-Efutu-Senya District, some individuals had made modifications on basic design principles for more improved roasting stoves constructed using clay. The modified improved stoves were maintained using clay mixture just like the traditional wood stove to prolong the lifespan.

From the above findings, if a complete processing unit is provided to a processing association (Group owned) or a community (community owned), then a commitment to manage the processing unit has to be enforced.

Adoption requirements for the high quality cassava flour technology

For the adoption of High Quality Cassava Flour (HQCF), the ready market /availability of market, consumer acceptability of HQCF based products/users prefer buying already processed flour, credit to purchase raw material, adequate training on quality issues and availability of dryer were necessary.

In Suhum Kraboa Coaltar District, adoption of HQCF technology highly depended on secured market. The other issues involved the availability of equipment for the production of HQCF especially proper drying facilities. In Awutu Efutu Senya District, HQCF processing technology was transferred to selected cassava processors, matrons of second circle institutions and bakers. Out of twenty people trained in HQCF, only one was utilizing the technology. Non adopters gave the following reasons:

1. Inconvenience associated with processing HQCF before using. Unlike wheat flour which was already processed for use, HQCF was not readily available and users had to process from raw cassava. It was suggested that HQCF needed to be processed and packaged for sale.

2. Extra labour requirement. Processors complained that production of HQCF was labour intensive and needed a lot of caution to meet quality standards.

3. Consumers were yet to develop taste for cassava and wheat based products. This according to respondents needed some time. Ghanaian consumers had already developed taste for wheat based products and therefore needed intensive promotion for a change.

4. HQCF is a new product. Adoption of new technologies has perceived effect of risk factors and implications on profit margins or probable losses.

Conclusions and Recommendations

Main cassava processing technologies transferred under Root and Tuber Improvement Programme (RTIP) were those involving the use of improved graters and pressers for the production of Gari and Agbelima, the use of improved stoves for the production of Gari and the production of High quality cassava flour (HQCF). With the exception of improved stoves, adoption requirements of the cassava processing technologies at the small scale level were similar in all the surveyed districts. The issue of affordability was critical to the acquisition of an improved grater or presser. Adoption decision on improved grater/press was made along the lines of efficiency of equipment, cost effectiveness/Implications on profit margins, adequacy of number of equipment especially with the use of cassava dough press, labour requirements, local capacity for repair and maintenance and site location.

With regard to adoption of improved stoves, the issues considered were fuel efficiency of stove design, location of the stove, availability of shed, labour requirement and
local capacity for repairs and maintenance. Due to lack of shed to house improved stoves a lot of processors had discontinued using improved stoves. Other factors of nonadoption included long roasting periods and supposedly high fuel use. Adoption requirement of High Quality Cassava Flour included the availability of market; consumer acceptability of HQCF based products, credit to purchase raw material, availability of dryer and adequate training on quality issues.

In addition to addressing the above mentioned adoption requirements, it was recommended that the transfer of improved stoves technology, efficient graters and hydraulic press must be encouraged through extensive education. There was the need for extensive training on maintenance of mechanized systems. Efficiency test on improved stoves vis-à-vis traditional wood stove should be researched into. Large scale processors should be assisted to access more sophisticated equipment and finance to purchase raw material and package products to meet highly competitive export market. Small-scale processors should be assisted to access improved equipment for processing HQCF especially dryers and adequate training on quality.

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