Processors' perceptions of various cassava processing technologies: A case study of selected districts in Ghana

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ABSTRACT

A purposive sample of 100 cassava processors were interviewed in the Suhum-Kraboa-Coaltar, Awutu-Efutu Senya, Ho, and Ga districts of Eastern, Central, Volta, and Greater Accra regions of Ghana, respectively, to assess their perceptions of various cassava processing technologies transferred under the Root and Tuber Improvement Programme. These technologies included production of high quality cassava flour (HQCF) and the use of improved stoves, graters, and presses for the production of "gari". To over 70 per cent of the respondents, the improved processing technologies were suitable to the village/community-based setting. However, the use of screw press was assessed to be labour-intensive, and lack of maintenance culture limited the efficiency of graters. Unearthing the opportunities in the cassava processing industry, small and large-scale linkages, and the use of intermediate processing options were thought necessary to meet local and export market demand.

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Introduction

Cassava (*Manihot esculenta*) is an important food crop in the tropics, a major carbohydrate staple consumed in various forms by humans. Furthermore, its usage as a source of ethanol for fuel, energy in animal feed, and starch for industry is increasing (Kehinde, 2006). According to FAO (2002), the tropical root crop cassava is the third most important source of calories in the tropics, after rice and corn. Over 600 million people depend on cassava in Africa, Asia and Latin America. Cassava is grown by poor farmers, many of them women, often on marginal land. For these people, the crop is vital for food security and income generation. Cassava is a key crop in Ghana, and is important to low-income farmers (including many women). In Nigeria and Ghana, the boost in cassava production has led to a glut on the market and depressed prices. Neighbouring countries like Benin are also affected, due to market integration (IFAD, 2007). Needs assessment studies in Ghana have highlighted farmers' concerns about exploiting market opportunities for cassava to absorb excess production (CTA, 2006). Market opportunities exist in the food, paperboard, plywood, textile, and industrial alcohol enterprises that would enable cassava to contribute significantly to poverty alleviation.

In Ghana, the Ministry of Food and Agriculture, under the International Fund for Agricultural Development (IFAD), implemented the first phase of Root and Tuber Improvement Programme (RTIP) from January 1999 to December 2004. The programme aimed at enhancing food security and increasing incomes of resource-poor farmers 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 reported cases of 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 "agbelima" (a fermented cassava mash), the use of improved stoves (Appiah, Nortey & Kagya-Agyeman, 2003) for the production of "gari" and high quality cassava flour (Dziedzoave, Graftham & Boateng, 2003).

As part of the evaluation of RTIP phase one, which was a precondition for formulating any second-phase project, this study was undertaken to assess the processors' perceptions of the cassava processing technologies transferred, and to identify constraints and opportunities for improvement in project implementation strategies. The findings would help address constraints associated with the existing cassava processing technologies, and show the opportunities for market expansion, locally and internationally.

Materials and methods

Rural Participatory Appraisal (PRA) techniques (Chambers, 1992) and Conventional Survey Methods were used in addressing the objectives of this study. For 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. A structured questionnaire was designed for the conventional survey, which covered a sample size of 100 cassava processors. This consisted of 90 small-scale processors in three districts: 30 each in Suhum-Kraboa-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 communities/villages covered under RTIP, and randomly identifying locations of beneficiaries with the help of extension agents in the districts surveyed. Processors' perceptions of the improved processing technologies were assessed for suitability of methods for local conditions, quality of end-products and selling price, as well as yields and demand.

Results and discussion

Equipment and suitability of improved methods

On the average, improved cassava processing technologies transferred under RTIP (including the use of improved graters and presses for producing "gari" and "agbelima", the use of improved stoves for the production of "gari" and high quality cassava flour) were suitable for the local conditions. Fig. 1 presents perceptions of respondents on the suitability of cassava processing technologies for the three districts surveyed.

In the Suhum-Kraboa-Coaltar District, cassava was mainly processed into "gari" and "agbelima". High quality cassava flour (HQCF) was produced by selected few, although more and more processors were developing interest at the time of the study. For "gari" and "agbelima" production, major unit operations included grating, pressing, and roasting. Most (75%) thought processing approaches used were suitable. A complete processing unit had a set of improved stoves, presses, and graters designed to encourage group processing. However, processors had not formed any formidable group; they preferred to process individually. The cassava-processing units were, therefore, used on service charge basis. The survey also identified an agro food processing factory with the state-of-the-art technology, which was easily accessed by individual processors for a fee. In addition to RTIP-sponsored cassava-processing demonstration units, some individuals had their own improved stoves. The clay-built type of improved stove with chimney was considered highly suitable. With the exception of the shed, construction materials were locally available. To most of them (73%), improved stove reduces smoke emissions and exposure to carbon dioxide. Processors were able to work faster, and product quality was improved. There was less heat exposure, though few (5%) complained of some unbearable smoke emission levels.

About 27 per cent of the sample interviewed did not find processing technologies transferred suitable. To this group, traditional pressing with stones was adequate because the energy requirement was similar to that for the screw press. Also, the use of improved stove had an additional cost (use of improved stove attracted a fee of GH¢0.20 per day). These processors complained about the inconvenience involved in carrying raw materials from their houses to the processing unit. Also, relocating to the processing site adversely affected time needed for other household chores; so they preferred traditional processing methods. Household chores were carried out alongside processing. The traditional earth stove was free of charge and more convenient to use.

Generally, because of its greater efficiency, respondents preferred the use of improved screw press to the traditional stone pressing method (Fig. 2). It took less time to dewater cassava dough, and was more hygienic to use. However, most (73%) processors interviewed in the Suhum-Kraboa-Coaltar District expressed the need for further improvement in the processing technologies. Energy requirement was still demanding, and liquid waste disposal inappropriate. Furthermore, the number of pressers at the various processing units was inadequate; and this forced many processors to resort to the old system. Some processors saw hydraulic press as

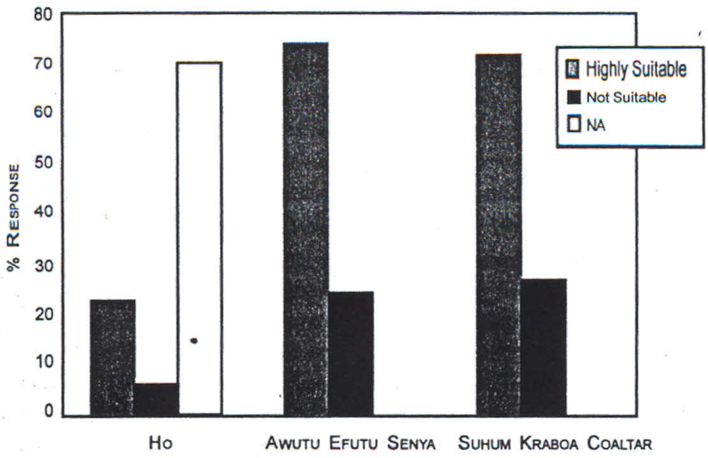

Fig. 1. Suitability of cassava processing technologies.

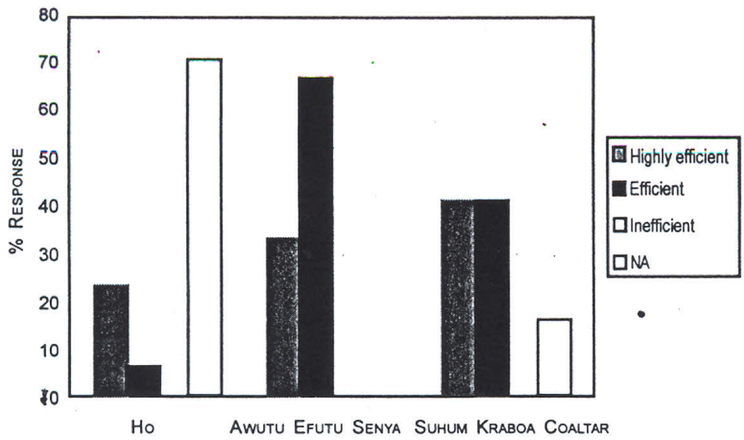

Fig. 2. Efficiency of cassava processing technologies.

position concerning the wind direction. Comparatively, loading intensity of the smokeless stove was low. There were reported cases of non-adoption of improved stoves in some communities, mainly due to lack of sheds for protection from adverse effects of the weather.

Although few respondents claimed that the traditional stove cooked faster, quality of product was improved with smokeless stove. Other health-related benefits associated with the use of smokeless stove, as enumerated by processors, included less exposure to heat and smoke. Smoke emission was a common problem with the use of traditional wood stoves of all kinds. There was smoke when lighting the fire and loading with new firewood as well as using semi-dried wood. Smoke was also associated with poor ventilation and inappropriate direction of vents or openings. All the respondents perceived smoke as bad. Smoke causes reddening of eye, wetting of nostrils, and eye irritation (Diaz *et al.*, 2007). Traditional wood stove users felt uncomfortable after cooking; offensive smell from clothes necessitated bathing immediately after roasting.

Responses on the efficiency of screw press and graters in the Awutu-Efutu-Senya District were favourable. Individual processors did not make any adverse comments about the efficiency, but rather complained bitterly about the inadequate number of improved presses. In the Ho District, 71 per cent of the respondents complained that they had not been exposed to any improved processing technology under the RTIP. Out of the 29 per cent who had been exposed to the improved processing technologies, 6 per cent complained about the unsuitability of the technologies, especially the improved stoves. Clearly, these were community-

more efficient. The improved graters were not very efficient as compared to already existing grating machines in the community, probably because of lack of maintenance. Grating had to be done twice for the desired cassava dough texture.

Cassava processing technologies in the Awutu-Efutu-Senya District were similar to those in the Suhum-Kraboa-Coaltar District, but with some variations in the improved stoves. Again, cassava was mainly processed into "gari" and "agbelima". High quality cassava flour technology was only transferred to selected individuals in the Winneba operational area, but adoption level was relatively low. Here, complete processing units were built by other development organizations. The group-processing approach did not work; rather, processors formed associations but operated along individual lines. Processors found the improved stove useful and suitable for the same reasons assigned by adopters in Suhum-Kraboa-Coaltar District. Responses on suitability of processing technologies were similar to the trends observed in Suhum-Kraboa-Coaltar District (Fig. 1). The smokeless stove was very useful to some respondents who indicated that it was more cost-effective. Fuel cost reduced by two-thirds, depending on the stove construction design and owned-types located out of reach of respondents. Closeness was a big issue here. Those who participated in the RTIP processing programme complained about inadequate numbers of screw presses in the district.

Quality of products and selling price

In Suhum-Kraboa-Coaltar District, responses on quality-related issues associated with adoption of improved processing technologies showed impressive results. About 58 and 42 per cent of the respondents in the district indicated very good and good quality of cassava products with the use of improved technologies, respectively (Fig. 3). Cassava dough was dewatered under more hygienic conditions with screw press than the traditional method of pressing with stones (Dziedzoave *et al.,* 1999). Product quality was improved with the use of improved stoves. However, selling price of end-product remained relatively unchanged. According to non-adopters of the improved processing technologies under study, the quality of end-product was highly influenced by processing experience, application of innovative processing techniques, and hygienic conditions of processing sites. According to the group, one could use the traditional method and obtain an equally high quality product. Product quality was also highly influenced by variety of cassava used (Oduro & Clarke, 1999). To some processors, variability in pricing of cassava products was limited.

In Awutu-Efutu-Senya District, about 75 per cent of the respondents indicated that the use of improved processing technologies had a positive effect on quality of the end-product. However, a significant percentage (25%) attributed the quality of cassava products to the level of expertise of the processor and the cassava variety, especially with "gari" production. Respondents opined that high quality products attracted premium selling price. Responses on quality of cassava products collected from using improved cassava-processing technologies were less revealing in the Ho District, because most respondents were non-adopters. About 38 per cent of the respondents were positive that the use of improved processing technologies turn out high quality products, especially HQCF.

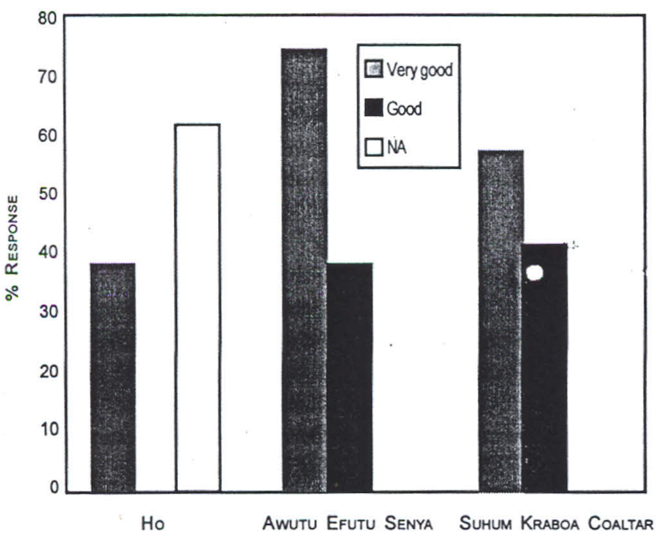

Fig. 3. Quality of products with cassava processing technologies.

Yields and demand

Responses on whether the use of improved processing technologies influences the levels of yields showed mixed results. In Suhum-Kraboa-Coaltar and Awutu-Efutu-Senya districts, those who indicated relatively no change and an increase in the levels of yields of cassava products from various improved technologies constituted 50 per cent each of the sample interviewed (Fig. 4). Those who indicated no change in the levels of yields or recovery rates as a result of the use of improved processing technologies explained that yields were highly influenced by the processing practices and, to some extent, by the cassava variety used. Those who indicated improvement in levels of yields

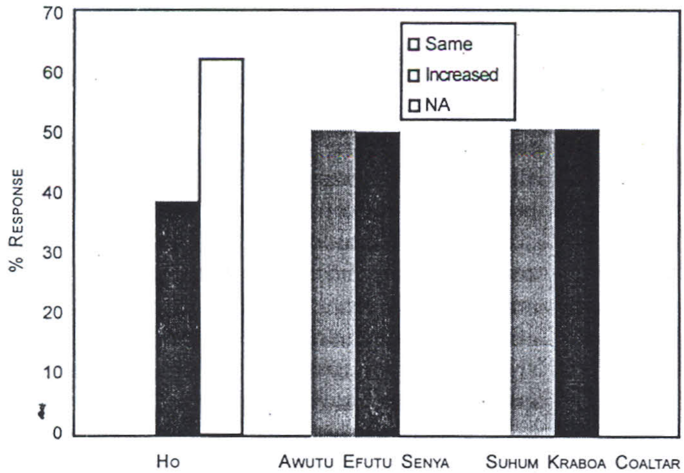

Fig. 4. Yields of cassava products using improved processing technologies.

explained that efficient graters gave less by-products or lumps. Usually, lumps from sieved cassava dough were processed into "kokonte" (dried cassava chips milled into flour) largely for household consumption. In the Ho District, technology adopters strongly thought that yields from cassava processing were highly influenced by the amount of water in the raw material used, all other things being equal.

According to respondents, demand trends for cassava processing products, especially "gari" at the small-scale level, had increased over the years. However, respondents in all the districts surveyed were quick to add that increased demand could not be attributed to the use of improved processing technologies, though they influenced productivity positively. Processors were better placed to meet high-demand orders. Most indicated that "gari" in particular was lifted immediately when sent to the local market. Others had orders placed by exporters. Yet there were some processors who preferred institutional buying arrangements with less risk payment terms. At the large-scale level, respondents were optimistic about increase in demand for HQCF for industrial purposes. Demand for dried cassava products (especially "agbelima") was expected to trend upward as more and more people developed taste for healthy foods (Scott, Rosegrant & Ringler, 2000). The issue of cost associated with the use of improved processing technologies was a concern to all processors interviewed. The small-scale processors could not afford the high cost of processing equipment. Table 1 summarizes advantages and disadvantages of improved cassava processing technologies.

Constraints

Constraints with the use of improved grater and screw press:

- Frequent breakdown of screw press
- Sacks sometimes burst during dewatering with press
- Inefficient cassava graters; some graters turn out less quality product. Blades are blunt
- Lack of pressing platform
- Improper disposal of liquid waste
- High labour requirement for screw pressing

Constraints with the use of improved stoves:

- Spacing between ovens too small
- Lack of funds to construct sheds for improved stoves
- Improper location or positioning of improved stoves
- Inconvenience associated with stove height

Constraints with high quality cassava flour processing:

- Lack of credit for bulk purchase of raw material
- Lack of efficient drying equipment
- Long processing period or time
- Lack of hydraulic press for producing HQCF
- Lack of equipment for sifting HQCF

TABLE 1

Advantages and Disadvantages of Improved Processing Technologies

Improved unit/product	*Advantages over traditional*	*Disadvantages over traditional*	*Suggested improvement*
Smokeless stove	Processors were able to work faster due to less smoke and reduced heat exposure and health-related risk. Product quality is improved; gari is more crispy	Needs well-constructed sheds. Few processors prefer the traditional stove because of its ideal height and good sitting posture	Spacing between chimneys rather small. Stove could still be improved further
Cassava press	More hygienic and gives better quality gari. It is very efficient; days used to dewater reduced from 3 to 1. Processors could meet urgent orders and quality is improved.	Gari prepared from stone press gives a bitter taste, which is preferred by some consumers.	Reduce labour requirement associated with screw press.
			Hydraulic press is more efficient and should be encouraged
	Short fermentation makes gari sweet. Though easy to operate, it is labour-intensive.		
Grater	Some are not efficient and do not give smooth products. Blade gets blunt easily, but far better than manual grating		Could still be improved
HQCF	Demand for industrial use is high	It is labour-intensive Sun-drying is not reliable	Need efficient driers (preferably gas dryer). Solar driers are not durable.

Source: Authors' Compilation; November, 2004.

Opportunities

■ *Potential of cassava products for export*

World market demand for certain cassava products, especially the HQCF, for use as industrial raw material is growing, and the potential exists for large volumes of export of these products (Plucknett, Philips & Kagbo, 2000; Graftham & Westby, 1998; Graftham *et al.*, 1998). Various export initiatives have already been taken by large-scale processors; and these initiatives need to be encouraged to lift the cassava processing industry to the international level.

■ *Small and large-scale linkages*

With growing export market for cassava products, the opportunity exists for developing linkages between small and large-scale processors to take advantage of external markets. As small-scale processors could not meet huge export demand orders, small and large-scale processors need assistance. Small-scale processors need improved equipment for processing HQCF, especially dryers and adequate training on quality issues; while large-scale processors need more sophisticated equipment and finance to package products to meet the highly competitive export market.

■ *Intermediate processing opportunities*

It was realized from field observations that most cassava glut areas did very little processing, because processing plants were sited close to market centres and not necessarily close to the source of raw material. Therefore, opportunities exist for semi-processing in such areas before lifting by large-scale processors for final processing and packaging to reduce transportation cost. This needs strong private sector involvement (Westby, 2002).

■ *High local demand for HQCF*

Opportunities exist for producing HQCF with more promising market demand trends. There was a potential demand for HQCF for use as adhesive in the plywood and paperboard industries. In addition, cassava flour was being extensively promoted in composite flours in the bakery industry, especially in the Brong Ahafo Region. Opportunities exist for HQCF uptake in the bakery industries because of the relatively high cost of wheat flour. The necessary requirements are availability of quality drying mechanism and finance for raw material purchases. For maximum advantage of the opportunity, the need is also for proper education of end-users on the profitability and other benefits of HQCF.

An impact assessment of Integrated Cassava Research and Development in Colombia (Gottret & Raymond, 2000) showed that agricultural research can contribute tangibly to poverty alleviation, but with the following conditions that (1) market and post-harvest research and development are integrated with production technology research agenda; (2) inter-institutional partnerships are developed, whereby different institutions with their own expertise, comparative advantages, and mandates collaborate to respond to the demands of local community organizations and individuals; and (3) existing social and human capital is used to create intimate networking among institutions, local social organizations, and individuals.

Conclusion

Over 70 per cent of processors interviewed perceived the improved cassava processing technologies transferred under RTIP as suitable to the village/community-based setting. Although demonstration units (a unit has a set of improved stoves, presses and grater) were designed with intentions of encouraging group processing, use of facilities by individuals on service charge basis was preferable. Constraints facing processors included frequent breakdown of screw press, inadequate presses at processing sites, inefficient cassava graters, lack of pressing platform, and improper disposal of liquid waste. High quality flour production-related constraints were lack of drying and sifting equipment, while high heat exposure between chimneys due to inadequate spacing, lack of capital to construct shed, and long roasting periods were difficulties associated with the use of improved stoves.

The study recommended extensive training on maintaining mechanized systems, encouraging export initiatives already taken by large-scale processors, and assisting small-scale processors to access improved equipment for processing HQCF, especially dryers. 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. Linkages between research and industry should be strengthened to facilitate the development of SMEs, as also suggested by Chuzel (2001).

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