Technological changes in shea butter production in Ghana: A case study of shea butter production in the Yendi District of the Northern Region of Ghana

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ABSTRACT

This study investigated technological changes in shea butter production in the Yendi District of Ghana and how processing could further be improved. A qualitative research and analysis of six communities and 36 shea butter processors in the Yendi District indicated that shea butter processors have changed from roasting whole kernels to crushing the kernels before roasting. Shea butter processors have mechanised the milling of roasted kernels and abandoned manual milling. Crushing of kernels and 'beating' of shea kernel paste have also been mechanised; however, only few processors are using this method. Shea butter processors need improvement in the areas of cooking shea kernels, 'beating' of shea paste, and packaging of shea butter.

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RÉSUMÉ

OKORLEY, E. L., FORFOE, F. K. & NASHIRU, S.: *Changements technologiques dan la production de beurre de karite au Ghana*: *Une étude de cas de la production de beurre de karité dans le district de Yendi de la Région du Nord du Ghana.* Le beurre de karité s'en sert pour la nourriture et pour les buts cosmétiques pour des siècles en Afrique. A part être une graisse végétale pour la cuisine, il possède la capacité de garder et de protéger la peau contre les dégats de l'environnement. La production de beurre est une activité économique importante dans le district de Yendi et elle a été entreprise de toute éternité. Actuellement, le beurre de karité a atteint une telle position économique (locale et internationale) que ces méthodes de production ont devenu important à ses demandes et à ce qu'il se sert à faire. Ce projet étudiait les changements technologiques qui s'opéraient dans la production de beurre de karité dans le district de Yendi et comment le traitement pourrait être encore amélioré. Des recherches et des analyses qualitatives de six communautés et de trente-six processeurs de beurre de karité dans le district de Yendi indiquaient que les processeurs de beurre de karité ont changé de rôtissage de grains complets à l'écrasement de grains avant le rôtissage. Les processeurs de beurre de karité ont mécanisé la mouture de grains rôtis et abandonné la mouture manuelle. L'écrasement de grains et la batture de la pâte du grain de karité ont été également mécanisés, cependant, peu de processeurs seulement appliquent cette methode. Les processeurs de beurre de karité exigent une amélioration dans les domaines de cuisson de grains de karité, de batture de la pâte de karité et d'emballage de beurre de karité.

Introduction

Shea butter has been used for centuries in Africa for its unsurpassed ability to maintain and protect the skin from environmental damage, and for cosmetic and food purposes. The shea tree has been referred to as "God sent" to the people of Africa (Acquaye *et al*., 2001). The indigenous people of Africa trade in shea butter, eat it, and rub their bodies with it (Hall *et al*., 1996; Chalfin, 2004). They also burn it to make light and use it as remedy against aches, pains, sores and wounds (Hall *et al*., 1996; Chalfin, 2004). Poulsen (1981) reported that the shea tree is the second most important oil crop in Africa after oil palm. The shea tree grows naturally in the wild in the dry Savannah belt of West Africa (Fobil, 2002). This Savannah belt in Africa has over 500 million fruiting shea trees with an estimated potential production of about 1,760,000 tonnes of shea nuts per annum (Fobil, 2002). From this potential production, only 35 per cent of the nuts are gathered and processed locally.

Recent changes in the European Union regulations on the use of substitutes for cocoa butter have increased demand for shea butter from chocolate confectioners, because it is now possible to blend up to 5 per cent of shea butter into chocolate products (Ferris *et al.*, 2001). In 2000, the Department for International Development funded the Natural Resources Institute of Ghana to conduct a pilot project to test the feasibility of operating a Small and Medium Enterprise shea butter extraction venture that could supply about 50 tonnes of shea butter to the Cocoa Butter Equivalent (CBE) industry per annum (Gallat & Collinson, 2000). Also, a renewed and rising interest in shea butter has been reported from the cosmetics industry worldwide (Ferris *et al*., 2001).

In Ghana, particularly the Northern Region, the shea tree is important because it grows in areas unsuitable (annual rainfall less than 1000 mm) for the growth of many other cash crops which require over 1000 mm rainfall per annum (Fobil, 2002). While international demand for shea butter is increasing, Ghana's estimated 9.4 million shea trees with potential yield of about 100,000 tonnes of shea nuts per annum seem to be decreasing. For instance, in 2001 the export of shea nut was 45, 281 tonnes, but this decreased to 27,627 tonnes in 2002, a percentage decrease of 39 per cent (ISSER, 2002).

The demand for large quantities of shea butter from Ghana is due to good quality butter with low free fatty acid contents. This is partly due to good post-harvesting practices. Shea butter production is an important economic activity in Northern Ghana. The crop is particularly important to household income and food security for rural women in the area.

The two major commercial outlets available to shea butter producers are cosmetic buyers and CBE buyers. Cosmetic buyers buy small quantities of the butter, but are prepared to pay high prices because they want shea butter with certain active ingredients and intrinsic properties for beauty care (Ferris *et al*., 2001). Such a product for the cosmetic buyer is now secured through the traditional method (usually manual), which, for the amount of fat extracted, is less efficient. The CBE buyers require large quantities of shea butter extracted by solvents, because it is cheaper owing to high efficiency in the extraction process (Ferris *et al.*, 2001). The CBE buyers do not need the active ingredients that give shea butter its intrinsic properties needed by cosmetic buyers (Ferris *et al.*, 2001).

In Ghana, the traditional method (manual) is the predominant way of producing shea butter, despite its reported drudgery and inefficiency. However, several efforts are aimed at eliminating the drudgery and improving the efficiency of producing high-quality shea butter, especially for the cosmetic market (Ferris *et al.*, 2001).

Thus, the overall purpose of the study was to find out the technological changes that had occurred in shea butter production among the local people in the Yendi District over the years (as far as respondents could remember), and to draw lessons from them to improve the current methods.

The specific objectives set for this study were to:

1. identify and describe the various technologies that have been used to date in harvesting and transportation of shea nuts, production of shea kernel, extraction of shea butter, and in packaging and storage of shea butter;
2. find out the reasons behind their current practices in shea butter production; and
3. identify problems associated with the methods of producing shea butter by local shea butter processors in the Yendi District.

Materials and methods

The research adopted a qualitative approach to data collection and analysis. The research aim can best be realised by collecting in-depth information from relatively few players rather than a limited scope of information from many people as is true with quantitative methods (Peacock, 1986). The phenomenon under study is contemporary and involves understanding change and processes in a real-life context. The qualitative case study method is more suitable for such research (Yin, 1994).

The research was conducted in the Northern Region of Ghana with the Yendi District as the case study area. The target population comprised individuals and groups involved in shea butter production. A combination of purposive and random sampling approaches was used in selecting the locations and the respondents for the study. The Yendi District is surrounded by Gushiegu-Karaga District to its north, the Nanumba District to its south, Zabzugu-Tatali District to its east, and the Tamale Metropolis on its western part. All the districts are notable areas of shea butter production. The Yendi District with a population of 130,504 (Population and Housing Census Data, 2000) was purposively selected for the study because of the central position it occupies geographically and commercially (in shea butter trade). Shea butter production is a major income-generating activity in the district. Other income-generating activities in the district include farming, groundnut oil extraction, and weaving.

The six major areas of shea butter production in the Yendi District selected for the study were Guntingli, Zagbang, Sambu, Gbungbaliga, Sunson, and Kuga. Six shea butter processors were purposively selected from each of the six communities as key informants for the study because of their long experience in the shea butter production business, and could talk about their past and present experiences in shea butter processing. In all, 36 shea butter producers were used for the study.

Data were collected through semi-structured interview schedules, focus group discussions, and observations. Focus group discussions enabled the respondents to describe, in detail, the processes involved in producing shea butter and the changes that had taken place as far as they could remember. As a way of triangulation, the focus group discussion, which involved six individuals selected randomly from the pool of the 36 processors, was used to cross-check on information provided by individuals in the interviews because data collected relied mostly on the memory of respondents.

The data collected were mainly descriptive and qualitative. Descriptive statistics, including means and percentages, were used in the analysis only for organizing the responses of the 36 key informants for better understanding. The intention is not to generalize the findings to cover other populations of shea butter producers in Ghana. However, the idea is that much can be learnt from this case of shea butter producers in the Yendi District. The text-based approach of summarizing, aggregating, and explaining emerging issues from discussions and observations provided the logic in analysing the data collected (Carney, 1990).

Results and discussion

Generally, shea butter is produced in the Northern Region of Ghana, particularly in the Yendi District, exclusively by women and as individuals. The 36 shea butter processors who provided the information in the study were all women without any formal education. Eighty-six percent (31) of the processors were operating as individuals, with the rest (14%) each belonging to a group of shea butter producers in the study area.

Scale of shea butter production in the Yendi District

Shea butter production in the Northern Region of Ghana is at small-scale level. The study in the Yendi District shows that production of shea butter by local women ranges from the processing of 1to10 head pans (20-200 kg) of shea nut per week (Table 1). When groups are involved or the opportunity exists to use mechanical crushers and 'beaters', the processing goes to about 15 head pans (300 kg) per week.

TABLE 1

Scale of Shea Butter Production in the Yendi District (N=36)

Head pans of nuts per week*	*Frequency*	*Percentage*
1-5	20	56
6-10	10	28
11-15	6	17
Total	36	100

NB: Mean = 6.1 Standard deviation = 3.8, * Head pan = 20 kg
Source: Survey (2003)

Technologies in shea butter production in the Yendi District

The study found local shea butter production to involve four distinctive stages: harvesting/ collection, production of shea kernel, extraction of butter from kernel, and packaging and storage. Each stage involves one or more activities. Fig. 1 shows the various stages.

Harvesting of shea nuts

Predominantly, the main method of harvesting shea nut in the Yendi District and the surrounding districts is by picking self-fallen nuts from the wild (Fig. 2). However, a few (e.g. 0.08% of the respondents), in addition to picking fallen fruits, also do selective harvesting by manually harvesting mature and ripe shea fruits. The latter method, according to the respondents, provides wholesome fresh shea fruits for consumption. Children are usually used for this purpose by climbing the trees and either shaking the branches of the tree for ripe nuts to fall to the ground, or by touching selectively to harvest ripe fruits (ripe fruits are soft to touch).

The pattern of harvesting of shea nuts shown in the study area reflects the wild nature of the shea tree and, thus, the continuous hunting for fallen nuts in the wild. The study shows that on communal lands that are uncultivated, any one is free to pick or harvest shea nuts. On cultivated fields, only wives and mothers (for unmarried sons) are permitted by farmers to harvest nuts from shea trees found on their farms. Uncultivated fields, though open to all, are very far from homes. Processors in the Yendi District sometimes do walk about 15 to 30 km only to collect nuts, especially from uncultivated fields. The findings show that in the past people in the Yendi District and many

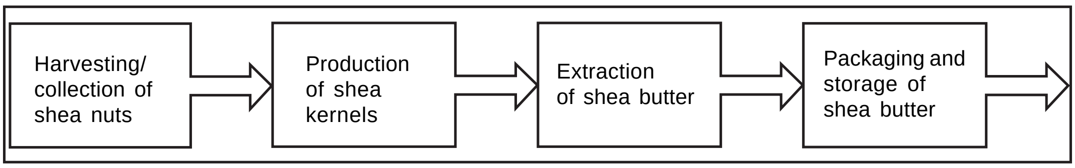

Fig. 1. Stages leading to shea butter production.

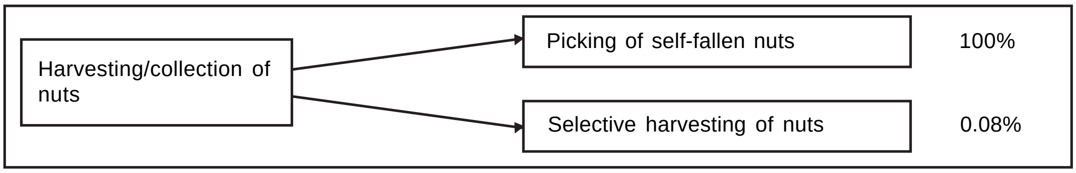

Fig. 2. Harvesting/collection of shea nuts.

parts of the Northern Region could harvest nuts from anywhere, either cultivated or uncultivated, and regardless of the owner as is still practiced in Mali (Gakou, Force & McLaughlin, 1994). This new development in the context of Ghana, and specifically in the Yendi District, is attributed to the understanding that shea nuts are now in high demand locally and internationally. Population has also increased in relation to the shea nut resource. Processors now compete for shea nuts, especially on the uncultivated lands, which are open to all. The women, therefore, walk long distances (15 - 30 km) to collect shea nuts in the uncultivated fields, subjecting them to a lot of dangers. Schrechenberg (1999) identified scorpion stings and snakebites as the main dangers in shea nut collection, especially in uncultivated fields. The collected shea nuts (usually between 20 and 40 kg per day) are transported by head loads.

Production of shea kernels

Respondents indicated that the processing of shea nuts into shea kernels involved fermentation and boiling, drying and shelling (Fig. 3).

a. Fermentation of shea fruit

The shea nut is surrounded by a pulpy material, which the respondents remove to get the nut. About 28 per cent of respondents ferment the shea fruits to ease this process. Shea butter processors heap freshly picked shea fruits on their compound for the pulp to ferment. Daily collection is added to the heap of nuts until it reaches a reasonable quantity to be boiled.

b. Boiling and sun-drying of shea fruit

The study shows that all the shea butter processors boil the shea fruits when the pulp around the fruit rots (for those who ferment the fruits) and the quantity collected is enough for a single batch of boiling. The quantity of nuts for such boiling depends on the individual. While some prefer boiling smaller quantities at a time, others prefer boiling larger quantities. Another factor that determines when the nuts should be boiled is the availability of bright sunshine, because shea nuts have to be sun-dried immediately after boiling for quality kernels. Shea butter processors boil the nuts for about 2 to 4 h. According to the respondents, the kernels from nuts that are not boiled yield very low amount of butter with relatively poor quality. This observation by the shea butter processors can be explained by the fact that boiling, together with fermentation, kills the embryo and prevents germination. Germination is noted to lower the

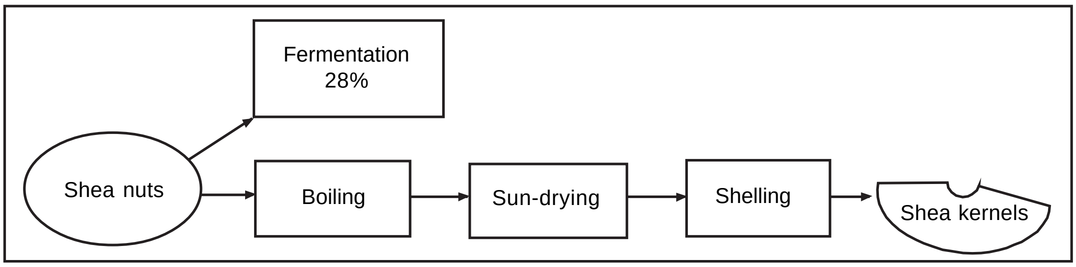

Fig. 3. Processing shea nuts into shea kernels.

quantity and quality of shea butter (Irvine, 1969; Ferris *et al*., 2001). After boiling, the nuts are evenly spread outside on mats to sun-dry for shelling.

c. Shelling/de-husking of shea nuts

Shea butter processors de-husk the dried nuts manually to get the kernels, although some variations exist on how it is accomplished. Generally, respondents use a flat piece of wood to break the nuts on a hard surface. Few (23%) shea butter processors pound the nuts with a mortar and a pestle. The shea butter processors indicated that the mortar-and-pestle method is only effective when the nuts are well-dried. Other methods known to be used elsewhere are trampling (Salunkhe & Desai, 1992) and cracking between two stones (Fobil, 2002). Fobil (2002) reported that cracking between two stones is possible, and can be a very effective method of cracking shea nut, but it is very laborious. Shea butter processors do winnowing to separate the broken shells from the kernels. The kernels are sun-dried for about 5 to 10 days for storage and use. Fobil (2002) asserted that moisture content of the kernels must be less than 7 per cent for safe storage, and that such kernels could be stored for about 2 years.

Extraction of shea butter

Shea butter processors identified five major activities, which lead to the production of shea butter from shea kernels. These activities include crushing, cooking, milling, “beating”, and refining. Mechanical and manual options exist for crushing and “beating”. Fig. 4 illustrates the extraction process.

a. Crushing of kernels

Shea butter processors in the Yendi District crush the shea kernels as the first activity of the extraction process. However, focus group discussions held with respondents showed that this was not so in the past; kernels were cooked in whole without crushing. The processors indicated that it takes a longer time to cook the kernel; it requires a lot of fuel wood and, thus, the efficiency of cooking is relatively lower.

Respondents identified two methods of crushing the kernels: the mechanical and manual methods. For mechanical crushing, the mechanical crusher breaks the kernel into pieces. About 33 per cent of the respondents used mechanical crushing (Table 2). This is due to the availability of mechanical crushers and the scale of production. The women mainly operate on small-scale processing, about 120 kg of nuts on the average per week (Table 1). Most (67%) processors did not have access to mechanical crushers, while others found it uneconomical because of their small-sized businesses. Shea butter processors use the manual method by crushing one or a few kernels on a stone slab, using a piece of wood designed for the purpose. Others pound the kernels using a mortar and a pestle. The processors found the former method of crushing to be more effective in producing crushed kernels of uniform size, but more laborious because it demands long hours of sitting. The latter, though less efficient, is faster; thus, reducing the sitting hours. Fobil (2002) reported that manual crushing can also be achieved using a stone and a wooden roller. Most (87%) respondents used manual crushing

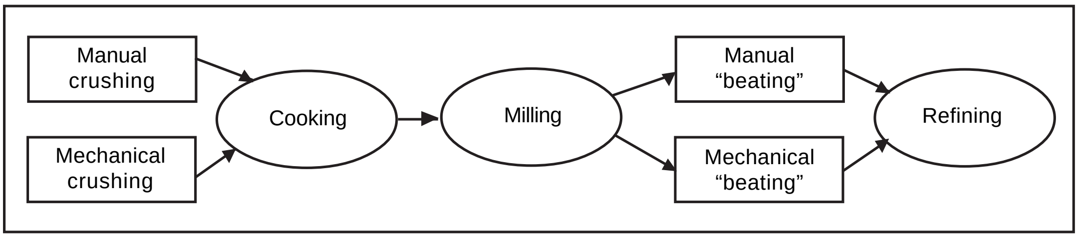

Fig. 4. The shea butter extraction process.

(Table 2), reflecting the subsistence nature of the shea butter industry in the Yendi District.

TABLE 2

Methods Used by Shea Butter Processors in the Extraction Process (N=36)

Activity	*Frequency*	*Percentage*
Manual crushing	30	87
Mechanical crushing	12	33
Cooking	36	100
Mechanical milling	36	100
Manual “beating”	36	100
Mechanical “beating”	3	8
Refining	36	100

Multiple responses: Respondents may add up to more or less than 36 or 100%

Source: Survey (2003)

b. Cooking

The kernel is cooked after crushing. The main utensil used for the cooking is aluminium pot and a piece of wood designed for stirring the content of the pot. The pot is put on a tripod and fire is set under it. When it is heated up, the crushed kernels are poured in and stirred regularly to ensure even cooking and to prevent charring. According to the processors, clay pots were used in the past. They indicated that aluminium pots are durable and cook faster compared to the clay pots. Shea butter processors assess the cooking quality of the kernels by taking a small quantity and adding a drop of water to it. A vigorous boiling and vaporization of the drop of water, which produces a characteristic sound, indicates well-cooked kernels. Cooked kernels have a darker colour. Undercooking or overcooking of kernels has adverse effects on the quality and quantity of butter produced.

c. Milling

All respondents were found to be using mechanical milling of the cooked kernels (Table 2), because the corn mill was adopted for the purpose, an observation also reported by Fobil (2002). Hitherto, this activity was handled manually. The manual milling involved pounding with a mortar and a pestle, and then grinding into paste with a stone on a slab. Respondents found the mechanization of the milling process not only time-saving and convenient, but also efficient because it increases the percentage of butter that is extracted from kernels. The milling process produces a paste, which is further processed for butter extraction.

d. “Beating”

Most (97%) respondents use manual “beating” (Table 2). According to the respondents, the “beating” process involves kneading the shea paste in cold water and later stirring vigorously with the hand while adding hot water at some intervals. This process aerates the fat to separate it from milled mass (Ayeh & Adomako, 1989). This continues until the mixture becomes gray and also leaves the hand clean. Cold water is then added to the mixture and stirred gently with the hand until a grayish scum floats on top of the water. This crude fat is removed and washed thoroughly in cold water. Fobil (2002) described this stage as the most crucial in determining the quality of the final butter product. However, the processors indicated that the effectiveness of the process determines the quantity of crude butter and shea butter that is produced. Fobil (2002) observed that the success of this stage depends on recognising changes in temperature, consistency and appearance, which can only be assessed correctly with experience. This was suggested as a major reason why shea butter processors usually carry out this activity in groups to share experiences for maximum effectiveness. Children also learn how to do the “beating” under the guidance of elderly and experienced processors. The option of mechanical ‘beating’ is available, but only to a few (3%) shea butter processors.

e. Refining

The study showed that all the shea butter processors were refining the crude fat manually. They do manual refining by melting the crude fat in a hot pot and boiling the content until a clear liquid, which is the shea butter, floats on top. The melted crude fat produces a suspension, which is flocculated by continuous boiling, resulting in the sedimentation of the heavier non-butter residue. The boiling process has to continue as long as needed to allow dirt rising to the top of the boiling mass to be removed with a ladle. The refining process usually takes about 3 to 5 h.

Fobil (2002) reported that adding the juice of *Cerathotheca* (a small Savanna plant) to the boiling contents of the pot accelerates the separation of the butter. A clear and bubbly liquid present in the pot implies completion of the refining process. It is then poured into a basin to cool and solidify. The liquid is stirred regularly as it solidifies to ensure a uniformly solidified butter. This solidification process is usually done early in the morning or late in the evening under shade. The residue under the pot after pouring off is further boiled to yield poor quality butter, which is part of the profit of processors. The local people usually refer to this poor quality butter as "maandugi", meaning re-cooked. The residue left after the "maandugi" is usually poured away. Recently, some shea butter processors dry it for use as fuel.

Packaging and storage of shea butter

The solidified shea butter is put into containers for the market or storage. Respondents make use of three types of packaging materials for shea butter: polythene bags, paper packs, and calabash. The use of the calabash is an indigenous method, whilst that of paper packs and polythene bags are recent innovations used by a few shea butter processors. The processors indicated that most buyers prefer paper packs and polythene bags to calabash because both can take larger quantities of butter, and are easier for handling and storage.

Constraints of methods of shea butter production in the Yendi District

A major constraint of the methods of shea butter production identified in the study was exposure of shea butter processors to direct heat from the fire during the cooking process, which presented a great discomfort to them. The manual cooking being practised now does not allow for the cooking of large quantities of kernels at a time, whilst inexperienced processors either undercook or overcook the kernels.

Another constraint indicated by the processors was the non-standardisation of packaging materials and price of shea butter in the Yendi market. Price was unrelated to weight, which did not favour the processors, especially during the bumper season.

The shea butter processors indicated that the manual "beating" in use now is tedious and time-consuming. They could only process little shea kernels at a time. Respondents think that the use of mechanical beating will increase shea butter yields through increased efficiency.

Conclusion

Based on the findings discussed above, the following qualitative conclusions can be drawn regarding the production of shea butter by the local people in the Yendi District:

1. Shea butter production in the Yendi District is in the hands of small-scale processors operating mainly as individuals.
2. The processors are females, invariably with no formal education.
3. The change in processing methods of shea butter is considerable among processors in the Yendi District:
    a. manual crushing (still the major method) to mechanized crushing (using motorised crusher);
    b. from cooking whole kernels to crushing before cooking;
    c. milling of cooked kernels has been completely mechanized (using mechanical millers);

d. manual beating (still the major method) is being shifted to mechanical 'beating' (motorised); and
e. use of calabash for packaging and storing shea butter is now being replaced with other materials such as polythene and paper containers.

4. The teething technological problems in shea butter processing identified by the processors were discomfort from direct exposure to heat, inefficiency in the use of the manual cooking method, non-existent standardised packaging materials for better pricing, and inefficient and tedious method of 'beating' shea paste to extract the butter.

For the shea production industry to be improved in the Yendi District and more so in the Northern Region of Ghana as a step toward improving the well-being of the local people, support toward improving the methods in producing the butter is required. This is a challenge to the District Assembly, research institutions, and non-governmental organizations to assist the processors to rethink their current practices in shea butter production and exploit more efficient options in the processing chain of the butter. A smokeless, heat-resistant, and fuel-efficient stove is a possible option for improving in part, the production conditions of shea butter processors in the Yendi District.

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