Journal of Agricultural and Crop Research
Vol. 4(1), pp. 1-8, January 2016
ISSN: 2384-731X
Research Paper

Level of awareness for adoption of improved shea nut processing technologies in Niger State, Nigeria

Koloche I. M* • Solomon S. • Hamza A. M • Garba M. H. • Mohammed A. • Yahaya S. A.

Nigerian Institute for Oil palm Research (NIFOR), Shea Tree Research Substation, Bida, Niger State, Nigeria.

*Corresponding author. E-mail: musakoloche66@gmail.com.

Accepted 28th January, 2016.

Abstract. This research assessed the level of awareness for adoption of improved Shea nut processing technologies in Niger State, Nigeria. Specifically, the study described the socio-economic characteristics of the shea nut processors, determined level of awareness of improved Shea nut processing technologies and the level of adoption of improved Shea nut processing technologies in the study area. A total of 150 shea nut processors were selected randomly. Primary data were collected and analyzed. The result showed that majority (60.00%) were between the age range of 41 and 50 years and the average age of shea nut processors in the study area was 42.07 years. The result also revealed that all (100%) of the processors were females. The results revealed that majority (78.00%) of the processors were married. The result also revealed that majority (55.33%) of the processors attended adult literacy programme. The result also indicated that majority (82.00%) of the processors were members of one cooperative society or the other. The results further indicated that all the shea nut processors were aware of the technologies in the study areas. However, the result indicated that majority (54.00%) of the processors adopted between 9 and 17 available improved shea nut processing technologies with exception of parboiling, sorting, grading, storage of shea nut and deodorant of shea butter and storage of shea butters. The result also indicated that age, processing experience and membership of association were related to adoption and statistically significant at 5% level of probability among the selected socio-economic characteristics. It was recommended that the processors should be sensitized on grade specification of shea butter to meet international standard.

Keywords: Adoption, technology, shea nut, shea butter, processing.

INTRODUTION

Shea tree grows in a large part of sub-Sahara Africa .The tree is important for the livelihood of rural population for centuries. Almost every part of shea trees is useful for example, the fruit is eaten and the leaves are used as fodder for livestock and serve as an ingredient for making alkaline and paint for industrial purposes (Lovett and Haq, 2000).

The butter that is either traditionally or mechanically extracted from shea nut which are produced by shea trees also have a lot of end-use applications which include: valuable oil for cooking, cosmetics and skincare, pharmaceutical and medicinal uses. The oil extracted from the seeds may have up to 50% oil content and when refined, Shea oil is used as a substitute for margarine and cocoa butter in the food industries (Suleiman, 2008).

Shea butter has great economic and nutritional potentials both locally and internationally and the demand for the commodity is experiencing a steady increase yearly (Suleiman, 2008). Shea nut products command an important position in the diet of the rural people in Northern Nigeria. Children, women and men eat the fruit while it is raw and the processed crude oil is also used as a food component. In most Northern villages, where cooking oil is scarce, shea oil serves as a close substitute that is used for cooking all traditional foods (Lovett and Haq, 2000; Suleiman, 2008).

In the first step, the green pulp exterior is removed. One method is to bury the fruit in the ground so that the pulp

ferments and falls off. This takes 12 days or more. The nuts are then parboiled or sun dried and then smoked for 3 to 4 days. The dried nuts can then be stored for long periods without significant losses. De-cortication is done by crushing the outer shell to remove the kernel. Shea nut are mainly exported as smoked kernels**.** The kernels will be further dried before any additional processing is carried out (Addaquay, 2004; LTA, 2004).

Traditional processing of shea nut by hand, is a slow and laborious process that uses large quantities of wood for roasting. The kernels are roasted in a pot over a fire at approximately 100°C and then pounded in a mortar to produce a coarse paste. This is then ground between two stones to produce a smooth paste. The paste and water are mixed in a pot where the butter rises to the top. The butter can then be removed and washed repeatedly with warm water until clean. The remaining water is removed by heating. Impurities settle out and the butter can be left to cool and solidify. With the traditional technique, the fat obtained is between 25 and 40% of the dry kernel weight (Addaquay, 2004).

The introduction of equipment can improve traditional methods of production by reducing the effort and time involved and by increasing the yield. Instead of pounding by hand, a mill can be used and oil can also be extracted using a mechanical or hydraulic press. Manually turned roasters can be used rather than a traditional pot. A very important consideration is the minimum time required to run the equipment profitably, including the initial cost, management of the equipment and maintenance (Lovett, 2004).

With the improved shea nut press, the fat is squeezed out of the heated shea-powder under high pressure. For a high amount of fat, a press is capable of given the required pressure of 125 bar. The fat must then be cleared of all residues by bringing it to boil together with okra, lemon juice and water. To increase the output, the process can be repeated. The resulting press cake is excellent for use as fuel for ovens and reduces the fuel wood demand. The amount of fat derived is determined by the condition of the shea nut. The yield will be greater if the harvest carefully stored and preserved. Complete inactivation of enzymes will prevent the formation of free fat acids. The heating of the powder to between 100 and 120°C is not difficult but the unassisted use of the press needs longer to learn. In order to get a maximum pressure of 125 bar a lot of force is required by the user (Schreckenberg, 2004).

Lovett (2004) also identified several factors that can affect shea butter quality. According to him these factors include the followings:

i) Level of maturity of the fruits;
ii) Conditions under which the collection of the fruits was done;
iii) Storage conditions of the fruits after collection;
iv) Fatty acid content in the endosperm;
v) Extraction technique;
vi) Conditioning technique; and
vii) Preservation condition of the butter.

In order to address the factors affecting quality, Lovett (2004) and Addaquay (2004) also stated that quality control should be conducted at the following levels:

a) Control of the raw materials (fruits, nuts, endosperm);
b) Control of pre-treatment operations (collection, cooking, drying, and preservation);
c) Control of the processing operations (extraction, conditioning); and;
d) Control of the quality of the butter (physic-chemical, organoleptic such as color, flavor, taste, texture).

This paper, therefore assess the level of awareness for adoption of improved shea nut processing technologies in Niger State. The specific objectives were to: describe the socio-economic characteristics of the shea nut processors in the study area and determine the level of awareness of improved shea nut processing technologies among processors in the study area.

METHODOLOGY

Area of study

The study was carried out in Niger State where there is a lot of wild shea tree plantation for domestic and commercial purposes. The state falls in the guinea savannah zone and has a climate and ecological conditions that favour agricultural production. It has an annual rainfall of between 1100 to 1600 mm and has an average temperature of 35°C (Gbako, 1991). The state has abundant wild vegetation of shea trees and is dominated by small-scale farmers. The major crops cultivated in the state are millet, rice, maize, guinea corn, beans, cassava, groundnuts and sweet potatoes. Majority of the farmers keep livestock like poultry, goats and sheep. Others engage in crafts such as sculptures, weaving and blacksmith (Publication of Projects and Programmes Documentation Unit, PPDU, 2009). Based on the 2006 National Population Census, the state has a total projected human population of 4,250,429 as at 2006.

Methods

In order to get a representative sample and to facilitate the achievement of the objectives of this study, multistage sampling technique was adopted for the study. The first stage was the purposive selection of the state for the study because of the abundance of wild vegetation of Shea trees in the state. The second stage

Table 1. Distribution of sampled shea nut processors.

Extension block	Extension cells	Number of registered shea nut processors	Number of villages selected	Numbers of processors selected
Gbako	6	118	9	43
Katcha	6	143	10	52
Agaie	6	151	12	55
Total	18	412	31	150

also involves purposive selection of Zone I based on the predominance of Shea trees (Suleiman, 2008). Simple random sampling technique was then applied to select three (3) Local Government Areas in the zone, namely: Gbako, Katcha and Agaie. The third stage was the random selection of six (6) extension cells from each extension block making a total of eighteen (18) extension cells. From the cells a total of thirty one (31) registered shea nut processing villages were purposively selected based on the frequency of shea nut processing activities. Finally, from the existing list of 412 shea nut processors with the state ADP, presently known and called Niger State Agricultural Mechanization and Development Agency (NAMDA), the state of Ministry Cooperatives and the Ministry of Women Affairs and GIZ State Field Office in Minna, 37% of the processors were randomly selected. This percent of the total population was taken giving to obtain total sample size of 150 shea nut processors as shown in Table 1. The sample size was selected at 5% precision level and at confidence level of 95% (Israel, 1992).

Data collection and instruments

The data for the study was mainly obtained from primary sources. Primary data were collected from a cross-sectional survey of registered shea nut processors through the use of an interview schedule with the assistance of trained enumerators that can communicate freely with the native language of the people in the study area. Descriptive statistics which include measure of central tendency, such as percentages, means and measures of variation such as variance and standard deviation were used to achieve the objectives of the study.

Analytical techniques

In testing the hypotheses, binomial logistic regression model was used to test for significant relationship between socio-economic characteristics and processors' level of adoption of improved Shea nut processing technologies in the study area. The model was used to determine the factors that influence the adoption of improved shea nut processing technologies. The independent variable (adoption level) was categorized into two levels on the basis of the number of technologies adopted by the processors. The processors that adopted 1 to ≤ 8 of the technologies are classified as low adopters and scored 0 while processors that adopted 9 to ≥17 technologies are classified as high adopters and scored.

The binomial logistic regression model for determination of significant relationship between adoption level of shea nut processors and the processors socio-economic characteristics is expressed as:

$$Y = \beta_o + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \ldots + \beta_nX_n \quad (1)$$

Where:
Y = 1 if the adoption level of the specified improved shea nut processing technology is high, 0 if the adoption level is low. X_1: Age; X_2: Sex; X_3: Education; X_4: Household size; X_5: Marital status; X_6: Processing experience; X_7: Training; X_8: Extension contact; X_9: Cooperative membership; X_{10}: Income; X_{11}: Quantity.

All these variables represent the vector of explanatory (independent) variables and β, are the coefficient of parameters to be estimated.

Pearson correlation coefficient was used to test the hypotheses while hypotheses three to five were tested using Pearson product moment correlation (PPMC).

RESULTS AND DISCUSSION

Table 2 shows the percentage distributions of the shea nut processors by age. The results revealed that majority (60.00%) of the processors fall within the age range of 41 to 50 years while 36.6% were 31 to 40 years old. The mean age of the processors was 42.07 years. This implies that the shea nut processors in the study area are still in their active age due to the presence of many young processors.

Table 2 shows the percentage distribution of the shea nut processors by gender. The results revealed that all (100%) of the processors were female. This implies that shea nut processing is mainly undertaken by women.

Table 2 shows the percentage distribution of shea nut processors by marital status. The results shows that majority (78.00%) of the shea nut processors were married. This implies that majority of the shea nut

Table 2. Distribution of the shea nut processors according to socio-economic characteristics (n = 150).

Socio-economic characteristics	Frequency	Percentage
Age		
31 – 40	55	36.67
41 – 50	90	60.00
51 - 60	5	3.33
Gender		
Female	150	100.00
Marital status		
Married	117	78.00
Single	33	22.00
Education		
Primary	14	9.33
Secondary	8	5.55
Adult	128	85.33
Household size		
1 - 5	5	3.33
6 - 10	61	40.67
11 - 15	64	42.67
Above 15	20	13.33
Processing experience		
Less than 10	2	1.34
10 - 20	62	41.34
Above 20	86	57.34
Extension contact		
Yes	129	86.00
No	21	24.00
Processing centre		
Yes	93	62.00
No	57	38.00
Membership of association		
Yes	123	82.00
No	27	18.00

Source: Field survey, 2012.

processors in the study area have additional responsibilities of catering for their households.

Table 2 shows the percentage distribution of shea nut processors by level of education. The results revealed that most (85.33%) of the processors had only attended adult literacy classes. This implies that processors had very low level of education. However, only educated farmers are reported to be analytical and to observe easily the obvious advantages of the technologies.

Table 2 shows the percentage distribution of shea nut processors by household size. The results indicated that (42.67%) of the shea nut processors had household size ranging from 11 to 15 people. Only few (3.33%) of the processors had a household size of 1 to 5 people. This implies that majority of the shea nut processors had large family sizes, which will provide family labour for processing. The mean household size of shea nut processors in the study area was 11.34 persons.

Table 3. Distribution of the shea nut processors according to number of training received (n = 150).

Number of training received	Frequency	Percentage
0	61	40.67
1	84	56.00
2	5	3.33

Source: Field survey (2012).

Table 4. Distribution of the shea nut processors according to sources of credit and labour (n = 150).

Parameter	Frequency	Percentage
Source of credit		
Personal	44	29.33
Family	58	38.66
Friends and neighbors	48	32.00
Labour		
Family	121	80.66
Communal	27	18.00
Hired	1	0.66
Friends and neighbours	1	0.66

Source: Field survey (2012).

Table 2 shows the percentage distribution of the shea nut processors by processing experience. The results indicated that majority (57.34%) of the processors had more than 20 years of processing experience, and only 1.34% of the processors had less than 10 years of processing experience. This implies that the shea nut processors in the study area had acquired enough processing experience that will encourage them to adopt improved Shea nut processing technologies.

Table 2 revealed that majority (86.00%) of the processors had contact with extension workers on the improved shea nut processing technologies.

Table 2 shows the percentage distribution of the shea nut processors by processing centre. The results revealed that majority (63.00%) of the processors had processing centres. This implies that the shea nut processors had avenues to interact and share ideas about improved shea nut processing technologies which can facilitate the adoption of the technologies.

Table 2 revealed that majority (82.00%) of the processors were members of one cooperative or the other. This implies that the members stand a better chance of receiving assistance from government and nongovernmental organizations (NGOs) or donor agencies.

Table 3 shows the percentage distribution of the shea nut processors by training received. The result indicated that majority (56.00%) of the shea nut processors had received training once, while 40.67% of the processors had no training. Only (3.33%) of the processors received the training twice. This implies that majority of the shea nut processors had need for more training.

Table 4 revealed that 38.66% of the processors used personal savings while 32.60 and 29.33% of the processors obtained their credits from family and cooperative associations, respectively. This implies that the processors did not patronize formal sources of credit such as commercial banks.

Table 4 revealed that majority (80.66%) of the processors used family labour to process shea nut while 18.00% used communal labour. Only 0.66% of the processors used hired labour. This implies that majority of the processors do not incurred extra expenses on labour.

Level of awareness of the shea nut processors in the study area

Table 5 shows the percentage distribution of the shea nut processors by level of awareness on improved shea nut processing technologies. The results revealed that all (100.00%) the processors were aware of the available improved shea nut processing technologies in the study.

Level of adoption of improved shea nut processing technologies in the study area

Table 5 shows the percentage distribution of rate of adoption of improved shea nut processing technologies of

Table 5. Distribution of the shea nut processors according to level of awareness and level of adoption of improved shea nut processing technologies (n = 150).

Technologies	Awareness		Adoption	
	No.	%	No.	%
Picking/collection of shea nut	150	100	150	100
Parboiling of shea nut	150	100	47	31
De-husking of shea nut	150	100	150	100
Drying of shea nut	150	100	150	100
Sorting/grading of shea nut	150	100	67	45
Storage of Shea nut	150	100	103	69
Drying of shea nut	150	100	150	100
Roasting of shea nut	150	100	150	100
Pounding of shea nut	150	100	150	100
Grinding of shea nut	150	100	150	100
Kneading/churning/washing of paste	150	100	150	100
Boiling/clarification of paste	150	100	150	100
Deodorant of shea butter	150	100	84	54
Clarification of shea butter	150	100	150	100
Packaging of shea butter	150	100	150	100
Storage of shea butter	150	100	89	59

Source: Field survey (2012).

Table 6. Distribution of the shea nut processors by adoption level (n = 150).

Adoption level	Frequency	Percentage
High adoption	84	56
Low adoption	66	44

Source: Field survey (2012).

the shea nut processors. The results revealed that majority (100%) of the shea nut processors adopted all the improved shea nut processing technologies, with the exception of five improved processing technologies namely par-boiling, sorting/grading, storage of shea nut, deodorant of shea butter and storage of shea butter. This implies that the processors are already familiar with most of the technologies. This may be as a result of newness of these technologies or certain attributes/characteristics such as time factor and lack of fund.

Adoption score and levels

The result in Table 6 shows the percentage of distribution of the shea nut processors by category and score. The results revealed that major (56.00%) of the shea nut processors adopted between 9 and ≥17 improved shea nut processing technologies while 44.007% of the processors adopted between 1 and ≥ 8 improved shea nut processing technologies. This implies that the processors were already use to the most of the available improved shea nut processing technologies for their effectiveness in achieving high quantity and quality of shea nut/butter. This also implies that the Shea nut processors had known the importance of the improved shea nut processing technologies

Constraints faced by the shea nut processors in the study area

The result in Table 7 shows the percentage distribution of the shea nut processors based on the constraints faced. The results indicated that majority (99.33%) of the processors had the problem of insufficient shea nut during the peak of the dry season for processing sufficient quantity of shea butter for commercial purposes, 72.00% of the processors complained of lack of credit facilities, while, 80.67% were faced by the constraints of seasonality in supply of shea nut. Similarly, majority (95.33%) of the processors were faced with the constraints of risk associated with picking/collection of shea nut, 55.00% of the processors were faced with problems of price fluctuation of shea butter. More so, 60.00% of the processors complained of poor processing

Table 7. Distribution of the shea nut processors according to constraints (n = 150).

Constraints to technology adoption	Constraints	
	No.	%
Insufficient shea nut	149	99.33
Lack of credit facilities	108	72.00
Seasonality in supply of shea nut	121	80.67
Risk associated with picking and collection	143	95.33
Problem of price fluctuation	66	56.00
Poor processing equipment	60	40.00
Poor quality of Shea butter produced	50	33.33
Poor capacity building support	95	63.33
Lack viability for commercial practicing technologies	98	65.33
Poor for organization of producers	150	100.00
Absence of sustainable policy of promoting the industry	65	43.33

Source: Field Survey (2012)

Table 8. Binomial logistic regression result of adoption level and some socio-economic characteristics.

Adoption level	Coefficients	Standard error	Z values	P > |Z|
Age	-.0669801*	.0367528	-1.82	0.068*
Household size	-.106529NS	.1474022	-0.72	0.470 NS
Educational level	.0949456NS	.0699154	1.36	0.174 NS
Cooperative mem.	2.26534***	.6837582	3.31	0.001***
Marital status	2.26534***	.6837582	3.31	0.001***
Processing exp.	.0315767NS	.05135 4	0.61	0.539NS
Ext. contact	2.43678***	.4206358	5.79	0.000***
Quantity proc.	-.0009725*	.0005503	-1.77	0.077*
Constraints	-3.247832*	1.954347	-1.66	0.097*

Source: Field survey (2012). N.B: * = Significant at 0.10% level; ** = Significant at 0.05% level; ***Significant at 0.01%; NS = Significant.

equipment while 66.67% of the processors complained of the poor quality of the shea butter produced. On the other hand, 63.33% of the processors were faced with the constraints of poor capacity building support. Also, 63.33% of the processors complained of lack of viability commercial practicing technologies. The results also indicated that all (100%) of the processors complained of the poor for organization of producers/marketers, while 43.33% of the processors were faced with the constraints of the absence of sustainable policy for promoting the industry. This implies that the shea nut processors were faced with numerous problems ranging from socio-economic to institutional factors.

The hypothesis was tested using binomial logistic regression analysis at 0.05% probability level. Table 8 shows the result of the analysis. The result revealed that membership of cooperative (X_9) marital status (X_5) and extension contact (X_8) were significant at 1% level of significance and had positive relationship with the level of adoption of improved shea nut processing technologies. This implies that apart from easiness of access to production resources, processors that were members of cooperative organizations interact and share ideas on the advantages associated with adoption of improved shea nut processing technologies. Similarly, marital status is a proxy of source of large household size which can serve as source of labour for the processors. Hence, shea nut processors that are married are most likely to have more helping hands in the processing of shea butter.

The result in Table 8 also shows that age (X_1) was negatively significant at 0.05% probability levels with adoption of improved shea nut processing technologies. This implies that younger shea nut processors adopt improved shea nut processing technologies more than older processors as old age is associated with weakness and skepticism, while youthhood is associated with virility and venturesomeness.

The result in Table 8 revealed that quantity (X_{11}) of shea nut/shea butter processed and constraints faced by the processors were positively significant at 0.05% probability levels with the level of adoption of improved shea nut processing technologies. This implies that the quantity of shea nut collected and processed had significant impact in their income and livelihood in terms

Table 9. Pearson relationship between the awareness and the level of adoption of the shea nut processing technologies.

Variable	R	Df	P-value
Adoption score	1.00	1	0.01** significant
Awareness score	1.00	1	0.01** significant

Source: Field survey (2012). N.B ** = Significant at 0.05 level, NS = Non Significant; * = Significant at 0.01 level

of improving the living standard of the processors.

Furthermore, education (X_3), household size (X_4) and experience processing (X_6) were not significant even at 0.10% probability levels.

The result in Table 9 revealed that there was significant relationship between the level of awareness and level of adoption of improved shea nut processing technologies. This implies that increase in the level of awareness will lead to increase in the level of adoption of improved shea nut processing technologies.

CONCLUSION AND RECOMMENDATIONS

From the study, shea butter processing activities is mainly women business, majority of the processors had processing centres and also belongs to different shea butter processing associations. The study also revealed that majority were trained either by government or non-governmental organizations (NGOs)/donor agencies on the improved shea nut processing technologies.

The study also reveals that all the shea nut processors were aware of the improved shea nut processing technologies but they were selective of the technologies adopted. The study also indicated that age, processing experience and membership of association were related to adoption and statistically significant at 5% level of probability among the selected socio-economic characteristics. The study indicated that majority of the shea nut processors faced between of constraints in shea butter processing as a business and they required assistance from government or non-governmental organizations (NGOs)/donor agencies.

Based on the findings of this study, it was recommended that the processors should be sensitized on the awareness on grade specification of shea butter to meet the international standard.

REFERENCES

Addaquay J (2004). The Shea Butter Value Chain Refining in West Africa WATH, Technical Report No 1 USAID, Washington DC. pp. 21-25.

Gbako ?? (1991). Focus on Gbako Local Government, Lemu, Niger State. Information pamphlet. pp. 1-5.

Israel ?? (1992). Social and Economic Research; Principles and Methods by Eric C Eboh 2nd Edition, Enugu: Published by Afr. Instit. Appl. Econ. Niger. p. 95.

Lovett PN (2004). The Shea Butter Value Chain Production Transformation and Marketing in West Africa WATH, Technical Report NO 2 USAID West Africa Programme. p. 5.

Lovett PN, Haq N (2000). Evidence for Anthropique Selection of the Shea nut Tree (*Vitellaria Paradoxa*). Agro-forestry Syst. J. 48:73-88.

Laboratoire de Technologie Alimentaire, LTA (2004). Technical Document: *Techniques ameliorées de production du beurre de karité.* Bamako, Mali: Institute d'EconomieRurale. p. 21.

Publication of Projects and Programmes Documentation Unit, PPDU (2009). Office of the Governor No. 1, Shehu A. Musa Road by Aliyu B. Abdulmalik, 2009 First Published in 2009. pp. 2-17.

Schreckenberg K (2004). The contribution of Shea butter (*Vitellaria paradoxa* C.F. Gaertner) to local livehoods in Benin, Chapter 6 of Forest products, livelihoods and conservation. Africa 2:25-147.

Suleiman MAT (2008). Assessment of Potentials for Shea nut in Selected Local Government Areas in Niger State. Report for Employment Oriented Private Sector Development Programme (EOPSD), Abuja, Nigeria. pp. 3-28.