Factors Affecting Shea Nut Collectors' and Shea Butter Producers' Willingness to Adopt Improved Shea Seedling in North-Central Nigeria

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ABSTRACT

Shea tree is highly valued because of its fat containing fruits. Traditionally North-central rural people are involved in shea nut collection and shea butter production. It is an economic venture for rural households. It present sound investment options for eradicating poverty. Despite the economic value of shea tree, is still growing in the wild and the improved shea seedling is yet to be adopted by farmers. Willingness is a major stage in adoption, and the adoption of improved technologies is one of the greatest challenges facing farmers. This study therefore examined, the factors affecting willingness of the shea nut collectors and shea butter producers to adopt improved shea seedlings. A three-stage sampling technique was used to select 200 respondents drawn from 5 Local Government Areas across two states of Kwara and Niger. And the total of 150 respondents was used for the study; consisting 78 shea nut collectors and 72 shea butter producers. Descriptive statistics and logit regression were used for data analysis. Majority (70%) were not aware of improved shea seedling while (72.67%) were willing to adopt the improved shea seedlings. Household size, gender, educational level, marital status, land ownership, membership of association, annual income, input cost, occupation, experience and extension contacts were the significant factors affecting the shea nut collectors and shea butter producers willingness to adopt improved seedlings ($p<0.05$). Government and all stakeholders need to collaborate with NIFOR in the area of mass production of improve shea seedlings to curtail the reliance on the natural regeneration of shea.

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INTRODUCTION

Shea tree is an indigenous butter oil producing plant. In Nigeria, shea is mostly found in the savannah province. Nigeria has the largest shea tree density and is the largest producer of shea butter in the world (FAO, 2013). Studies on the density importance of shea trees in the derived Guinea savanna, northern Guinea savanna, Sudan and Sahel savanna, showed Kwara, Oyo and Niger to have the largest shea tree densities (Odebiyi *et al*., 2004). Shea tree belongs to the family *sapotaceae,* with subspecies (*Vitellaria nilotica* and *V. paradoxa*). It can fruit for several years once productive. And fruiting is seasonal (Abdul-Moomin *et al.*, 2016). Shea tree can attain optimum yields of up to 45 kilogrammes per annum. Some shea tree can also produce between 50 and 100kg per annum. The kernels of shea fruits are made up of 40 to 50% oil (Bup *et al*., 2013). Shea tree has a unique resource for societal development. Traditionally, North-central rural people are involved in shea activities. These activities are economic ventures that serve as valuable income source for rural households in the region. Shea fruit collectors are the first group along the shea value chain and they are sometimes referred to as nut traders. They collect the shea fruits during the onset of raining season and process it to dry kernels. Shea butter producers add value to the kernels to produce shea butter which is the most important component of the shea tree. Shea nut and butter production activities represent a major source of income to mostly women and children in North-central Nigeria (Garba and Sanni 2015) and (Olife, 2013).

Shea tree are vulnerable species, mainly growing in the wild, this make their domestication very crucial. The tree, because of the resourcefulness of its nuts in tropical Africa was recommended among other trees as product of priority (FAO, 1991). Therefore the need to diversify the economy through mass production of improved shea seedlings. Recognizing the potentials of domesticating shea nut tree would lead to an increase in the establishment of sustainable shea resources for greater benefits in the near future. The fact remains that the shea nut collectors and shea butter producers still depend on the wild products. Despite the several socioeconomic benefits from the sale of shea nut/butter and its impact on poverty reduction, the improved shea seedling is yet to be fully adopted.

There is therefore the need to assess the respondents' willingness to adopt improved shea seedling. Willingness is a major stage in adoption, and the adoption of improved technologies is one of the greatest challenges facing the agricultural sector in Nigeria (Adekoya and Tologborse, 2005). Several studies have investigated the socio-economic factors affecting willingness to adopt new technologies. Recommendations from these studies have always been constrained by the fact that farmers' adoption behavior is highly diverse and influenced by a complex set of technology and site-specific socioeconomic variables (Buyinza and Naagula 2009). This research work however examined farmer's willingness to adopt improved shea tree seedlings and examine those factors that may influence the adoption behaviour of the target respondents. Besides, this relevant information will present clear evidence of areas that require private and government intervention with respect to the actor's adoption of improved shea seedlings for the purpose of increasing shea tree density.

METHODOLOGY

Study Area

North-central is vital for the study due to the abundant concentration of shea trees (Olaoye, 2011). Kwara and Niger State specifically formed the study area; they have the largest density of shea tree and shea nut activities in North-central Nigeria (Odebiyi, *et al.*, 2004, Suleiman 2008).

Sampling Procedure

Three-stage sampling technique was used. The first stage involved the purposive selection of 2 states in North-central Nigeria, specifically Kwara and Niger. The second stage involved the purposive selection of 5 Local Government Areas (LGAs) across the 41 LGAs in the two states. The third stage involved the selection of 40 respondents through random sampling technique in each LGA. The study sampled the total of 200 respondents randomly selected from 2 LGAs in Kwara State and 3 LGAs in Niger State. The responses from 150 respondents were used for data analysis, consisting 78 shea nut collectors and 72 shea butter producers.

Method of Data Collection and Analytical Techniques

The study was based on primary data elicited with the aid of well structured questionnaire. Both descriptive and inferential statistics was employed to analyze the data from the field survey.

Logit Model

The logit of a number "p" being either 0 or 1 is given by the formula:

$$\ln\left(\frac{P_i}{1-P_i}\right) = \sum_{k=0}^{k=n} \beta_k X_{ik} \quad \text{.....(1)}$$

It is the equation used to estimate the coefficients same as:

$$\ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 X_1 + \ldots\ldots + \beta_k X_k \quad \text{.....(2)}$$

Where Pi can be specified as: $P(Z = 1/X_1, X_2 \ldots\ldots X_k) = f(\beta_0 + \beta_1 X_1 + \beta_2 X_2 \ldots\ldots + \beta_k X_k)$ .....(3) *or*

Where β1-βk are the parameters to be estimated, Pr (Zi = 1) represent the dependent variable as the willingness of the shea nut collectors and shea butter producers to adopt improved shea seedling; taking the value of 1 as willing to adopt and 0 for otherwise. The model was specified implicitly as Pr (Zj = 1) = f (X_{1i},X_{2i},X_{3i},X_{4i},X_{5i},X_{6i},X_{7i},X_{8i},X_9,d_{1i},d_{2i},d_{3i},d_{4i},d_{5i}, d_{6i},)e……..(6)

Where Z= Zj and = willingness and j = category of actors. Then Z1: shea nut collectors and Z2: shea butter producers.

Z_1= Willingness to adopt improved shea seedling by shea nut collectors
X_1 = household size (number of persons in the household)
X_2= educational level (number)
X_3 = experience (years)
X_4 = number of seedling willing to plant (number)
X_5 = Amount willing to pay (₦)
X_6 = annual income (₦)
X_7 = extension contacts (number of times)
X_8= credit obtained (₦)
d_1 = marital status (married = 1, otherwise = 0)
d_2 = sex (dummy: 1 for male and 0 for otherwise)
d_3 = awareness of shea tree conservation (aware 1, otherwise 0)
d_4= land ownership (own 1, otherwise 0)

d_5 = membership of association (member = 1, otherwise = 0)
d_6= occupation (shea nut collector 1, 0 for otherwise)
Z_2= Willingness to adopt improved shea seedling by shea butter producers
X_1 = household size (number of persons in the household)
X_2 = educational level (number)
X_3 = experience (years)
X_4 = number of seedling willing to plant (number)
X_5 = Amount willing to pay (₦)
X_6 = annual income (₦)
X_9 = input cost (years)
d_1 = marital status (married = 1, otherwise = 0)
d_2 = sex (dummy: 1 for male and 0 for otherwise)
d_3 = awareness of shea tree conservation (aware 1, otherwise 0)
d_4= land ownership (own 1, otherwise 0)
d_5 = membership of association (member = 1, otherwise = 0)
d_6= occupation (shea butter producer 1, 0 for otherwise)

Table 1: Socioeconomic Characteristics of Shea Nut Collectors and Shea Butter Producers

Variables	Categories	% Pooled (n=150)
Age	20-30	14.69
	31-40	34.94
	41-50	30.72
	51-60	14.16
	>60	5.5
Experience	1- 10	31.79
	11-20	41.83
	21-30	18.16
	> 30	8.23
Education	None	1.34
	Non-formal	51.71
	Primary	27.89
	Secondary	15.81
	Tertiary	3.26
Household size	1-5	4.54
	6-10	29.92
	11-15	46.05
	16-20	14.69
	21-25	1.98
	>30	3.48
Gender	Male	3.26
	Female	96.74
Marital status	Married	82.05
	Otherwise	17.95
Other occupation	None	8.09
	Civil servant	2.57
	Trading	51.93
	Artisan	6.47
	Money lending	3.21
	Farming	27.73
Credit access		65.44
Membership of Association		68.38
Extension service		54.82

Field Survey 2019

As shown in Table 1, the modal age of the respondents' fall within the age range of 31-40 and 41-50 years and this constitutes 65.66% of the respondents. The mean age was found to be 42 years. This could be an indication that majority of the shea nut collectors and shea butter producers are still within the productive age limit during which they can fully and efficiently engage in all forms of productive labour. The mean years of experience of the respondents was found to be 17. Experience in the shea nut collecting and shea butter producing activities could define the productivity of the individual actor; which is expected to impact positively on the production activities. The results showed that the majority of the respondents (51.71%) had no formal education. Illiteracy could be a barrier for respondents to accept innovation. The mean household size of the respondents was 13 people. Larger family sizes are more

likely to adopt technology due to availability of sufficient and cheap labour and could be regarded as an added advantage for increased productivity. The study reported 96.74% respondents to be women and majority (82.05 %) were married. This is because marriage is also regarded as mark of honour and dignity which is held in high esteem in the study area. The result further revealed that the respondents (51.93%) and (27.73%) have their other income sources from trading and farming respectively. Income from other sources could boost the productive capital of the respondents and stimulate willingness to adopt improved technology. Majority of the respondents (65.44%) had access to credit that are mainly from friends, relatives and local cooperatives. Credit is a strong tool that is capable of enhancing the productive capacity of the respondents. The result revealed that 68.38% of respondents belong to an association. Being a member of association presents a great opportunity in shearing useful information through training to improve strategies in production activities. Majority (54.82%) of the respondents had access to extension services. Extension service is relevant in terms of transferring results of scientific research. Progress in the adoption of improved shea seedling could be achieved through extension services.

Table 2: Awareness and Willingness to Adopt Improved Shea Seedlings

Actors	Shea butter producers (n=72)		Shea nut collectors (n=78)		Pooled (n=150)	
Variable	Freq.	%	Freq.	%	Freq.	%
Aware	35	48.61	10	12.82	45	30.00
Not aware	37	51.39	68	87.18	105	70.00
Willing	57	79.17	52	66.67	109	72.67
Not willing	15	20.83	26	33.33	41	27.33

Field Survey 2019

The analysis in Table 2 showed that 30% of the shea nut collectors and shea butter producers are aware of improved shea seedlings. Further analysis revealed that more than 20% out of this were from Niger State. This could be attributed to their proximity to Nigerian Institute for Oil-palm Research (NIFOR) improved shea tree seedlings substation in Bida Niger State. Awareness is the first stage in adoption process and involves the individual learning of the existence of technological innovation (Ekong, 2003). More so, 72.67% indicated their willingness to adopt and plant improved shea seedlings. The high turnout of those willing to adopt could be attributed to the fact that the shea nut collectors and shea butter producers have been in the processing activities for a long period and the benefit they derive is undisputable.

Table 3: Shea Nut Collector's Willingness to Adopt Improved Shea Seedlings

Variables	Odds Ratio	Std. Err.	z	P>|z|	dy/dx
Total household size (X_1)	0.64514	0.09808	2.88	0.004**	0.10849
Educational level (X_2)	1.00154	0.0013897	1.11	0.269	0.00038
Experience (X_3)	0.1414	0.06942	2.17	0.03**	0.03274
No. of seedlings wln (X_4)	1.0028	0.00215	1.31	0.191	0.00069
Amount wilng to py. (X_5)	0.99702	0.00269	1.11	0.268	0.00074
Annual income (X_6)	3.14777	1.65891	2.18	0.03**	0.2838486
Extension contacts (X_7)	0.20797	0.16353	2.00	0.046**	0.3597
Credit obtained (X_8)	1.11261	0.09577	1.24	0.215	0.02641
Marital status (d_1)	1.41171	0.9239544	0.53	0.598	0.08539
Gender (d_2)	0.50947	0.36867	0.93	0.351	0.16677
Awareness (d_3)	0.9556	0.07831	0.55	0.579	0.01124
Land ownership (d_4)	0.21516	0.15268	2.17	0.03**	0.35738
Membership of asso. (d_5)	244.535	420.26	3.2	0.001**	0.87547
Occupation (d_6)	0.03158	0.04537	2.41	0.016**	0.67527
Number of obs = 78					
LR $chi^2(14)$ = 36.52					
Prob > chi^2 = 0.0009					
Pseudo R^2 = 0.3384					
Log likelihood = -35.701688					
Marginal effects after logit	y = Pr(willingnesstoadopt) (predict) = .54963586				

Field Survey 2019 (*) dy/dx is for discrete change of dummy variable from 0 to 1 Note: $*$ = significant at $P \leq 0.05$.

Table 4: Shea Butter Producer's Willingness to Adopt Improved Shea Seedlings

Variabl s	Odds Ratio	Std. Err.		P |z|	dy/dx
No. of seedling willn. (X_4)	0.99937	0.00237	0.27	0.791	0.00014
Amount willing to pay (X_5)	0.998625	0.00234	0.59	0.558	0.06098
Total household (X_1)	0 .7526749	0.10056	2.13	0.033**	0.15396
Educational level (X_2)	2.04908	2.82427	1.67	0.031**	0.284479
Annual Income (X_6)	0 .9073347	0.52915	0.17	0.868	0.02087
Input cost (X_9)	0.99985	6.4E-05	2.36	0.018**	0.324000
Experience (X_3)	1.07247	0.07124	1.05	0.292	0.015015
Marital status (d_1)	0.18887	0.155991	2.02	0.044**	0.32063
Gender (d_8)	1.18674	0.8493793	0.24	0.811	0.03633
Awareness (d_3)	1.0981	0.7238646	0.14	0.887	0.02008
Land ownership (d_4)	0.19865	0.1550067	2.07	0.038**	0.32063
Membship. of asso.(d_5)	7.530824	7.54393	2.02	0.044**	0.43481
Occupation (d_6)	0.13826	0.13781	1.99	0.047**	0.3673

Number of obs = 72

LR $chi^2(13)$ = 27.02

Prob > $chi^{2 =}$ 0.0285

Pseudo $R^{2 =}$ = 0.2784

Log likelihood = 35.024421

Field Survey 2019 (*) dy/dx is for discrete change of dummy variable from 0 to 1

The logistic regression of the shea nut collector's and shea butter producer's willingness to adopt improved shea seedlings is presented in Table 3 and 4. A pseudo R2 of 0.3384 and 0.2784 were obtained for shea nut collectors and shea butter producers respectively. A Pseudo R2 between 0.2 and 0.4 is considered highly satisfactory; therefore the dependents variables fit the models. The Chi-square statistic of 36.52 (p 0.0009) and 27.02 (p 0.0285) obtained for shea nut collectors and shea butter producers respectively were all less than 0.1 i.e. ($p < 0.1$) and were all significant, this shows that all the models were statistically significant and are of good fit for the analysis. More so, the chi-square significant values indicate a high interaction effect between the response variable and combination of explanatory variables included in the models. In order to find the effect of predictor variables on the willingness of the respondents to adopt improved shea seedlings, marginal effect (dy/dx) was generated. The marginal effects of shea collector's and shea butter producer's willingness to adopt were well predicted at 55% and 69% respectively, with the rate of willingness to plant improved shea tree higher amongst shea butter producers.

The variables of household size, annual income, extension contacts, experience, land ownership, membership of association and occupation for shea nut collectors were all significant at 5%. This implies that they all have positive influence on the respondent's willingness to adopt improved shea seedlings. For household, it implies that any unit increase in the number of persons, the log of odds of the respondent's willingness to adopt improved shea seedlings will increase by 0.0980818. The marginal effect of 0.1084928 of household size implies that there is 11% greater chance of adopting improved shea seedlings as the family members increase. It's logical to say larger family sizes are more likely to adopt technology due to availability of sufficient and cheap labor. Furthermore, other variables like annual income, extension contacts, experience, land ownership, membership of association and occupation were all positive and significant at 5%, which implies that a unit increase in annual income, extension contacts, experience, land ownership, membership association and occupation will increase their corresponding log of odds by 1.658907, 0.1635257, 0.1526755, 420.3595 and 0.0453732 respectively. And their corresponding marginal effects by 0.2838486, 0.324000, 0.0327383, 0.35738, 0.8754748 and 0.6752731 respectively, which will indicate 28%, 36%, 32%, 36%, 87% and 67% greater chance of shea nut collector's adopting improved shea seedling as the variables increase. The implication is this, as annual income increases from shea collection activities, the tendency to embrace shea tree planting will increase. Poverty reduces a household's willingness and ability to invest in agricultural technologies (Holden and Shiferaw 2002). Willingness to plant by implication will increase with the increase number of extension visits through sharing of information and training on adopting new ideas. Collector's years of experience would have given them the evidence of the relevant of conserving the shea tree resources. Experience is however expected to have a positive effect on willingness

to adopt improved shea seedlings. Availability of land and land size will definitely arouse the shea nut collector's willingness to adopt, the bigger the land the more willing to plant shea tree or respondents with bigger land are more likely to be willing. Membership of association could be an avenue for shearing useful information about improved technologies, this however could be a stimulating factor for the shea nut collectors to adopt improved seedling. Membership of social organization refers to social participation in organization which enhances interaction and exposes rural dwellers to information about improved technologies, therefore high success rates in adoption of improved technology when they work in groups. Furthermore, as shea collectors remain in their activities of shea nut collection as the main occupation, the chance of adopting improved shea seedling will increase knowing the relevant of their activities over time.

More so, the variables of household size, educational level, input cost, marital status, land ownership, membership of association and occupation were all significant at 5% for shea butter producers. This implies that they have positive influence on the producer's willingness to adopt improved shea seedling. It implies that a unit increase in any of the variable will increase the corresponding log of odds by 0.7526749, 2.049078, 0.9998489, 0.1888719, 0.1986537, 7.530824 and 0.1382569 respectively. And the marginal effects of 0.153959, 0.2844786, 0.324000, 0.4348072 and 0.3672988 of household size, educational level, input cost, membership of association and occupation of shea butter producers will indicate 15%, 28%, 33%, 43% and 36% greater chance of adopting improved shea seedling respectively. While the log of odds of marital status and land ownership will increase by 0.18887 and 0.19865 respectively and their corresponding marginal effects of 0.3206314 and 0.3206314 will indicates 32% greater chance of the shea butter producer's to be willing to adopt improved shea seedlings. Level of education being significant confirmed the apriori expectation of a positive relationship between willingness to adopt and education. A higher level of education is expected to increase respondents' ability to acquire, process and use information to their advantage.

Summary of the Major Findings

The mean age of the respondents is an indication that majority of the shea nut collectors and shea butter producers are still within productive age limit, with considerable practical years of experience in production activities and large household sizes. Thirty percent of the shea nut collectors and shea butter producers are aware of improved shea seedling and majority indicated their willingness to adopt. Household size, gender, educational level, marital status, land ownership, membership of association, annual income, input cost, occupation, experience and extension contacts have positive effects on the willingness to adopt improved shea seedlings among the shea butter producers and shea nut collectors ($p<0.05$).

CONCLUSION AND RECOMMENDATIONS

Based on the research findings, majority were not aware of improved shea seedlings but were found to be willing to adopt the improved shea seedling. The willingness to adopt improved shea seedlings among the shea nut collectors and shea butter producers were influenced by their socioeconomic characteristics and production resources. The willingness of the respondents to adopt improved shea seedlings need to be addressed for the sustainability of shea tree in North-central Nigeria.

In order to sustain the use of shea tree, the study recommends the provision hybrid of shea with a reduced gestation period to actors that are willing to adopt. This will encourage shea tree planting and curtail the reliance on natural regeneration of shea. Government and all stakeholders need to collaborate with NIFOR in the area of mass production of improved shea seedlings at affordable rate. Extension contacts, land ownership and input cost should be taken into consideration when developing strategies to stimulate willingness to adopt shea seedlings.

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