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Socio Economic Factors Influencing Adoption Of Improved Gum Arabic Seedlings Among Farmers In The Sahelian Zone Of Borno State, Nigeria

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Abstract:
The study analysed the socio economic factors influencing adoption of improved gum Arabic seedlings among farmers in the sahelian zone of Borno State, Nigeria. The data for the study were mainly generated from farming households through the use of structured and pre-tested interview schedules. Multi-stage, purposive and random sampling techniques were employed to select 321 representative farming households that were used for this study. Both descriptive (frequencies, means and percentages) and inferential (logit regression) statistics were used to analyse the data collected for this study. The result showed that most (49.20%) of the respondents had farmer cooperatives as their source of gum Arabic seedlings in the study area. This is closely followed by fellow farmers representing 40.18% of the respondents in the study area. The logit regression analysis indicated that the socio-economic characteristics which had significant influence (P≤0.10) on the adoption of improved gum Arabic seedlings by farmers include; marital status and household size. The study recommends that awareness creation should be mounted through extension education approach to enlighten the public on the skills, knowledge, techniques and benefits of the adoption of improved gum Arabic seedlings in the study area. Farmers in the study area should also be encouraged to form gum Arabic agroforestry cooperatives in order to enable them to take advantage of government and non-governmental programmes, such as provision of credit facilities and technologies etc.

Key words: *Adoption, Factors, Farmers, Gum Arabic seedlings, Nigeria*

1.Introduction

Gum Arabic (Acacia species) is the exudates obtained from the various species of the genus Acacia. There are about 1100 spp distributed over tropical and sub-tropical areas of Africa, India, Australia and America. However, only Acacia senegal (grade 1) and Acacia seyal (grade 2) yield gum of economic significance (Odo and Oleghe, 1998). The optimum conditions for the growth and performance of the plant are excessive heat, high elevation and sandy soil with scarcity of moisture (Sagay, Igboanugo, Imarhiagbe, and Mesike, 2007). Production of gum arabic in Nigeria is largely from the wild except in Borno, Jigawa and Yobe State where plantations of several hectares were established. Gum arabic production is exclusively from gum bearing trees and local producers are typically peasant farmers picking gum exudates as a secondary or complementary source of revenue (Sagay, Igboanugo, Imarhiagbe, and Mesike, 2007). They also reported that picking of gum exudates is a source of revenue in rural areas and gum Arabic tree indirectly contributes to the improvement of the environment in areas threatened by desertification. Production of gum arabic in Nigeria is largely from the wild (Odo and Oleghe, 1998). However, many efforts are made in the gum arabic growing states in the country to establish gum Arabic plantation on a large scale.

Natural gums and resins are among dry land resources in Sub-Saharan Africa that contribute to improved livelihoods of local communities in terms of food security, income generation and foreign exchange earnings. These resources also contribute to the amelioration of the environment. (Odo and Oleghe, 1998).Plant gums from trees are of two types: exudates (ooze from the tree/shrub as a result of injury) and seed gums (isolated from the endosperm portion of some seeds). Exudate gums are the main forms produced in Africa. Gum Arabic, a dried exudates obtained from the stems and branches of Acacia senegal or A. seyal. The two species are native to the hot and dry regions of Africa (FAO, 2007).The use of gum arabic has been widely reported in industrial application (food and beverages, pharmaceuticals, cosmetics, textiles). The Acacia trees are also Nitrogen - fixing and hence improve soil fertility. Other uses include provision of pods for livestock feed, shelter belt planting to control desertification and provision of timber. It is an important revenue earner for the country and employer of labour for rural people who are engaged in production and gum collection. Chikamai, Casadei, Coppen, Abdel, Cesareo,(1996) reported that g ums provide both social and economic benefits to rural populations at the subsistence level. The social benefits are reflected in the many

local uses they offer to the communities: the use of *gum arabic* as a food by children or herdsmen in the bush; myrrh as ink in some schools or burnt in houses to repel snakes or dangerous insects; chewing of frankincense as a gum and burning as incense among local populations. Gum collection is carried out as parts of livelihood strategies at household level, e.g. to secure provision of food and other essential subsistence goods and social security (Giroh, Wuranti, Abubakar, and Ogwuche, 2005).Gum arabic are widely cultivated in the Sudano- Sahelian zone of Nigeria covering about 250,000 sq km in the entire Sahelian region spreading across twelve states namely Bauchi, Borno, Gombe, Jigawa, Kano, Katsina, Kebbi, Sokoto, Yobe, Adamawa, Zamfara and Taraba. Bello, (1998) reported that 7 out of the 19 species of gum arabic reported in Nigeria were found in the northern Guinea and Sudan savanna areas of Adamawa State. The rainfall regime of these zones ranged from 900 – 1100 mm and 700 – 900 mm per annum with rainfall duration of 4- 5 and 3- 4months respectively. Gum arabic production in Nigeria has been low arising from lack of capital to boost production, use of improved planting materials amongst other factors. To harness the current potentials for gum arabic production and export, its production must be improved. Production must shift from the traditional form to the use of cultivation in organized plantation with intercrop based combination for maximum economic benefit. Considering the importance of improved gum arabic seedlings, the study was aimed at analysing the influence of socio economic characteristics respondents on adoption of improved gum arabic seedlings in the Sahelian zone of Bomo State, Nigeria .In Nigeria, the greatest problem facing human existence has been deforestation and environmental degradation (Adeola, Baba, Popoola and Adebisi,2001). As a result of deforestation, the vegetation has undergone substantial deterioration, particularly the gun trees in the sahelian zone of Nigeria. The vegetation of Borno State, is a characteristic habitat that has been altered due to human interference with the Sahelian zone worst affected. In realization with the objective of improving the livelihoods of the rural people, Borno State Government established "Gum Arabic Development Project" that covered all the gum producing LGAs since 2002 where seedlings produced was delivered to farmers free of charge supported by extension services from Bomo State Agricultural Development Programme (BOSADP). Field observations revealed that farmers do not practice the technologies promoted. Furthermore, farmers' production is low, due to failure to uptake gum Arabic seedlings.

Several researches have been conducted on the adoption of gum Arabic agroforestry in Nigeria (Odo and Oleghe, 1988; FDA, 2002). However, there has not been any empirical study into the analysis of adoption of improved gum Arabic seedlings among farming households in the Sahelian zone of Borno State,Nigeria.

2.Objectives Of The Study

The main objective of the study was to analyse the socio economic factors influencing adoption of improved gum Arabic seedlings among farmers in the sahelian zone of Borno State, Nigeria. The specific objectives were to:

investigate socio-economic characteristics of the respondents;

determine sources of improved gum Arabic seedlings among respondents;

examine adoption of improved gum Arabic seedlings among respondents**;** and

analyse the relationship between socio-economic characteristics of respondents and their adoption of improved gum Arabic seedlings in the study area.

3.Methodology

3.1.The Study Area

The study was carried out in the Sahelian zone of Borno state. Borno state has a land area of about 69,436 Km^2 and lies within 11^o to 14^oN and longitude 10^o to 14^oE (BOSADP, 2003). It is located in the North Eastern part of Nigeria and shares international border with the republic of Chad to the Northeast, Cameroon to the East and Southeast and Niger republic to the North. Within the country, it is bounded by Adamawa state to the South, Yobe state to the West and Gombe state to the South. The Sahelian zone is comprised of ten (10) Local Government Areas (LGAs) namely; Abadam, Gubio, Guzamala, Magumeri, Marte, Mobbar, Monguno, Nganzai, Ngala and Kukawa. This environment has a population of 1,243,068 (NPC, 2006).

3.2.Sources Of Data

The data for the study were obtained through primary and secondary sources. Primary data were mainly generated from farming household through the use of structured and pre-tested interview schedules. The secondary data comprising information from Area Extension Officers (AEOs) of the BOSADP were used to complement the primary data.

Other sources of secondary information include; Textbooks, Journals, Publications and other write-ups that are relevant to this study.

3.3.Sampling Procedure And Sample Size

Multi stage, purposive and random sampling techniques were employed for selecting the representative farming households that will be used for this study. The Sahelian zone of Borno state comprised ten (10) LGAs. Therefore, the first stage was the purposive selection of four (4) major gum Arabic producing Local Government Areas (Magumeri, Mobbar, Guzamala and Kukawa) in the study area. . The second stage of sampling was the proportionate selection of villages per Local Government Area (12 from Magumeri; 14 from Mobbar; 3 from Guzamala and 4 from Kukawa) to make a total of 33 villages sampled in the study area. The list of villages were obtained from the Area Extension Officers (AEOs) and used as sampling frame. The third stage was the random selection of ten (10) households from each of the selected villages. A total of 330 farming households were therefore, selected as the sample size for the study. However, 321 respondents were used for the analysis, because nine of the questionnaires were not properly filled.

3.4.Analytical Techniques

Both descriptive (frequencies, means and percentages) and inferential (logistic regression) statistics were used to analyse the data collected for this study. Descriptive analytical techniques such as frequency distribution and percentages were used to categorize the farming households based on socio-economic characteristics, as used by Onu (2006). The inferential technique that was used in this analysis was the logistic regression analysis. The SPSS computer package was used to estimate the logistic regression analysis.

The Mean Scores were measured by using a three – level scale; Likert type as used by (Bishwa, 2003). In this scale, each item was scored as follows;

Agreed (A) (2 points)

Disagreed (DA) (1 Points)

Undecided (U) (0 Points)

The scores obtained by the respondents were weighted in order to get their mean. Weighted scores refer to the respondents' scores against each item multiplied by the

scores under each Likert scale point. The products will be added together on each column in order to find out the average (mean) scores using the number of respondents to be involved. The mean (average) obtained were interpreted as follows:

Interpretation scale:

≤ 1.55 = DA - Disagreed

1.56 – 2.55 = N - Neutral

≥ 2.56 = A - Agreed

Mean scores were used to determine the perceived effects of adoption of gum Arabic agroforestry on livelihood among the farming households as used by (Daniel, Gilbert, David, Bruce, M.and William,1996; Bishwa, 2003). This technique was used to measure variables in objective three and four.

3.5.The Logit Model

In this study, the determinants of adoption of gum Arabic agroforestry were analysed using maximum likelihood estimation of a logistic regression model. This is because the dependent variables, adoption of gum Arabic agroforestry were dichotomised by assigning a value of one if the farming households head adopted gum Arabic agroforestry and zero otherwise. Given that the dependent variable is dichotomous, the regression is non-linear in nature and ordinary least squares techniques result in bias by over estimation and inconsistency (Maddala, 1983) and it has been shown that a Logit analysis is more appropriate in such cases (Adesina and Seidi, 1995; Mukadasi and Nasalegwa, 2008).Therefore, a logistic model technique was used to regress the adoption of gum Arabic agroforestry on a set of explanatory variables. The use of Logit, which gives the maximum likelihood estimate, overcame most of the problems associated with linear probability models and provides estimators that are asymptomatically consistent and efficient (Maddala, 1983). Many studies have used the logistic analysis approach to examine similar issues in different agro-ecological zones and for different technologies (Alavalapati, Lukert, and Gills, 1995; Ayuk, 1997; Mukadasi and Nasalegwa, 2008). The Logit model was used to achieve specific objective two. The implicit form of the logit model was expressed as:

$Y = B_o+B_1X_1+B_2X_2\ldots\ldots\ldots\ldots\ldots\ldots+B_nX_n+e$ ----------(i)

Where:

Y = Adoption of improved gum Arabic seedlings

B_o = Intercept

B_{1-n} = Parameters to be estimated

X_{1-n} = Set of independent variables

The independent variables specified as determinants to be used in the logistics regression analysis are defined as follows:

X_1 = Sex of household's head; Dummy (D) = 1 if male; 0 if otherwise,

X_2 = Age of Household.

X_3 = Marital status of household's head; Dummy (D) = 1 if married, 0 if otherwise,

X_4 = Household size (number),

X_5 = Formal Education (years),

X_6 = Membership of cooperative societies by household's head; Dummy (D) = 1 if yes; 0 if otherwise,

X_7 = Household Labour (Number),

X_8 = Non-farm income (Naira),

X_9 = Farming experience (Years),

X_{10} = Farm size (hectares),

X_{11} = Access to agricultural credit; Dummy (D) = 1 if yes, 0 if otherwise,

X_{12} = Access to extension services (Number of contacts per season),

X_{13} = Farmland ownership; Dummy (D) = if owned; 0 if otherwise,

X_{14} = Access to mass media; Dummy (D) = 1 yes; 0 if otherwise,

4.Results And Discussion

4.1.Socio-Economic Characteristics Of Respondents

Farming households generally differ in socio-economic characteristics. These characteristics influence the capacity of households in adopting innovations. Such differences in socio-economic characteristics of households also provide the context within which the adoption behaviour of farmers could be understood. The socio-economic characteristics of respondents in this study area are presented in Table 1.

Variable	Frequency	Percentage (%)
Sex		
Male	298	92.8
Female	23	7.2
Age		
≤ 20	43	13.4
21 – 30	91	28.3
31 – 40	90	28.0
41 – 50	57	17.8
≥ 51	40	12.5
Marital Status		
Married	297	92.5
Single	24	7.5
Household Size		
≤ 4	38	11.8
5 – 8	97	30.2
9 – 12	103	32.1
13 -16	58	18.1
≥ 17	25	7.8
Formal Education (Years)		
< 5	42	13.1
5 – 8	109	34.0
9 – 12	88	27.4
13 – 16	58	18.1
> 16	24	7.5
Farm Size		
≤ 4	48	15.0
5 – 8	113	35.2
9 – 12	105	32.7
13 – 16	43	13.4
≥ 17	12	3.7
Ownership Of Farmland		
Hired/ rented	59	18.4
Personal	144	44.9
Family	118	36.8
Farming Experience		
≤ 3	44	13.7
4 – 6	108	33.6
7 – 9	100	31.2
10 – 12	51	15.9
≥ 13	18	5.6
Membership Of Cooperatives		
Not a member	55	17.1
≤ 2 Years	264	82.2
3 – 4 Years	1	0.3
5 Years and above	1	0.3

Table 1: Distribution Of Respondents By Socio-Economic Characteristics (N=321)

Source: Field Survey; 2011

4.1.1.Sex

Table 1 reveals that majority (92.80%) of the respondents were male, while only 7.20% of them were female. The over whelming majority of the male farmers could be that farmers constitutes the households head and except in a situation where the household head is a female. This implies that majority of them may have better access to extension contact and other necessary farm inputs. This is in the line with earlier studies as reported by Agea, Joseph, Sara, Mukadasi, and Daniel,2005) that gender plays significant role in having access to production resources and hence adoption of technologies.

4.1.2.Age

The results in Table 1 also revealed that majority (69.70%) of the respondents fell within the age bracket of 40 years and below; while only 30.20% of the respondents were within 41 years and above. By implication, the study area has large number of young farmers who have the potentials for adoption of improved farm technologies. Ajayi, Akinnifesi, Sileshi, and Chakerdza, (2007) reported that young people are more likely to be better agents for technology adoption and transfer as they may have higher aspiration to accept new technologies compared to older farmers who are skeptical and critical of innovations. Age, therefore has implications for technology adoption in particular and agricultural production in general.

4.1.3.Marital Status

The study revealed that the majority (92.50%) of the respondents were married, while only 7.50% were single (Table 1). Marital status has implication for adoption of improved technologies. Married people have more responsibilities and hence they take what ever they do with seriousness. In that case, they will be willing to seek improved technologies so as to enhance the welfare of their families on the other hand, especially with regards to females being married can be a serious hindrance to accessibility of technologies. This is more especially in the study area where there culture restricts interaction between male and female. Women could attend functions, including extension training only with the consent of their husbands.

4.1.4.Households Size

Results from the study showed that most (32.10%) of the respondents had 9-12 members per family. This implies that significant component of the labour force comes from the family. Family labour is an important component of labour for small scale farmers. This is mainly because the subsistence farm households are resources poor and they may have to depend on family labour for agricultural activities which in most cases is labour intensive.

4.1.5.Formal Education

The study showed that majority (53.00%) of the respondents had nine (9) years and above of formal education, while only 13.10% of them had less than 5 years of formal education. Education affects agricultural productivity by increasing the ability of farmers to produce more output from given resources. Literacy level is also related to the intensity of use of improved technologies. The implication could be that high level of education in the study area could mean that majority of the farmers we expected to adopt new technologies within a relatively shorter period of time. This is partly because, given the high level of education, majority of the respondents are expected to gather, process and interpret information relating to technology adoption as well as make production decision more easily

4.1.6.Farm Size

As shown in Table 1, most (35.20%) of the respondents had between 5-8 hectares of land, 15% with less than 5 hectares, and 32.70% having 9-12 hectares of land. It could be seen that the respondents had a fairly relatively large size of land in the study area. This implies that the respondents could adopt improved technologies without hindered from the farmland side. Giroh, Wuranti, Abubakar, and Ogwuche, (2008) reported that because farm size is an indication of the level of economic resources available to farmers there is probability of utilizing improved technologies if farm size increases.

4.1.7.Ownership Of Farmland

The study indicated that most (44.90%) of the respondents operated their farming activities on personal land. About 36.80% of them operated on family farmland, while only 18.40% operated on rental farmland. Ownership of farmland has implication for

security of tenure of farmland. Gum Arabic agroforestry production requires security of gum trees. The study indicated that a significant section of respondents had their personal farmland which augers well for the production of gum Arabic agroforestry in the study area. This implies that the respondents might adopt improved gum Arabic agroforestry technologies in the study area.

4.1.8.Farming Experience

The result showed that about 13.70% of the respondents had less than four years of farming experience. Most (33.6%) of the respondents had 4 – 6 years of farming experience in the study area. The study indicated that only 5.60% of the respondents had 13 and above years of farming experience. It could be implied that the respondents had a reasonable years of farming experience to enable them in adopting gum Arabic agroforestry technologies in the study area.

4.1.9.Membership Of Cooperatives

The result in Table1 showed that about 83% of the respondents were members of cooperatives, while only about 17% of the respondents do not belong to any farmer cooperatives. Out of those who belong to farmer cooperatives, about 82% had less than 3 years of membership. The study shows that they had less years of experience being as a member of cooperatives. Membership of cooperatives has bearing on the capacity of farmers to adopt technologies. For instance, farmer cooperatives link members to sources of technologies, educate their members on how to utilize such technologies as well as link them to markets. These could influence adoption of improved technologies among members of cooperatives. However, the lower years of being membership could negatively affect the uptake of gum Arabic agroforestry technologies in the study area.

4.2.Sources Of Improved Gum Arabic Seedlings By Respondents

The source of improved gum Arabic seedlings available among respondents in the study area included extension agents, farmer cooperatives, own nursery and fellow farmers. These variables are presented in Table 2. The result showed that most (49.20%) of the respondents had farmer cooperatives as their source of gum Arabic seedlings in the study area. This is closely followed by fellow farmers representing 40.18% of the respondents in the study area. Extension agents had 10% of the respondents, while own nursery had

only 0.62% of them in the study area. The result implies that extension agents had no significant influence as source of gum Arabic seedlings which could adversely affect the adoption of technology by respondents in the study area.

Source of technology	Frequency	Percentage (%)
Extension agents	32	10.00
Farmer cooperatives	158	49.20
Own nursery	2	00.62
Fellow farmers	129	40.18
Total	**321**	**100.00**

Table 2: Distribution Of Respondents By Major Sources Of Gum Arabic Seedlings Source Of Technology
Source: Field Survey; 2011

4.3.Socio-Economic Factors Influencing Adoption Of Improved Gum Arabic Seedlings

The socio-economic characteristics that influence the adoption of improved gum Arabic seedlings by farmers include; marital status and household size. These factors were statistically significant and positive at 10% level of significance (Table 3). The coefficient of marital status was found to be significant ($P \leq 0.10$) and positively related with the adoption of improved gum Arabic seedlings in the study area (Table 3). The result shows that as one marries the willingness for adoption of improved gum Arabic seedling increases. The implication could be that married people have more responsibilities and hence they could adopt improved gum Arabic seedlings with a view to improving the livelihoods of their families.

Variable	coefficient	Std. Coef.	Z	P	95% Conf. Interval	
					Lower	Upper
Sex	-0.0504	0.4531	-0.11	0.912	0.39	2.31
Age	-0.04235	0.09644	-0.44	0.661	0.79	1.16
Marital Status	0.9455	0.5039	1.88	0.961*	0.96	6.91
Household size	0.1713	0.1061	1.61	0.106*	0.96	1.46
Educational level	-0.0749	0.1056	-0.71	0.478	0.75	1.14
Farm Size	0.1440	0.1152	1.25	0.211	0.92	1.45
Labour	0.0099	0.1161	0.09	0.932	0.80	1.27
Ownership of land	0.1152	0.1632	0.71	0.480	0.81	1.55
Farming experience	-0.0357	0.1095	-0.33	0.744	0.78	1.20
Farmer Cooperatives	0.1519	0.3185	0.48	0.633	0.62	2.17
Extension contact	0.5155	0.6533	0.79	0.430	0.47	6.03
Source of technology	0.1244	0.1074	1.16	0.247	0.92	1.40
Access to credit	-0.0279	0.2101	-0.13	0.894	0.64	1.47
Constant	-2.530	1.275	-1.98	0.047		

Table 3: Logit Analysis On Factors Influencing Adoption Of Improved Gum Arabic Seedlings

Source:Regression Extract

** Significant At 10%*

The result in Table 3 revealed that the coefficient of household size was found to be significant ($P \leq 0.10$) and positively related with the adoption of improved gum Arabic seedlings in the study area. The result shows that as the household forms the main source of labour in African agriculture, especially where farmers practice agro forestry. The need for family labour is more where activities relating to agroforestry practices in question are labour intensive, such as production activities of gum Arabic seedlings and where the farmers are basically subsistent.

5.Conclusion

The study revealed that most of the respondents adopted recommended gum Arabic seedlings in the study area. However, most of the respondents had farmer cooperatives as their source of improved gum Arabic seedlings in the study area. The results also indicated that the socio-economic characteristics that influenced the adoption of improved gum Arabic seedlings by farmers include; marital status and household size.

6.Recommendations

Based on the findings of the study, the following recommendations were made; -

Agricultural credit should be provided with no collateral for improved adoption of gum Arabic seedlings in the study area.

Awareness creation should be mounted through extension education approach to enlighten the public on the skills, knowledge, techniques and benefits of the adoption of improved gum Arabic seedlings in the study area.

Tripartite arrangements should be made by governments (Federal, State and Local Governments) to promote production of gum Arabic seedlings to be distributed to farmers free of charge through the support of extension services.

Farmers in the study area should be encouraged to form gum Arabic agroforestry cooperatives. This will enable them to take advantage of government and non-governmental programmes, such as provision of credit facilities and technologies etc.

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