



ASSESSMENT OF FACTORS AFFECTING THE ADOPTION OF NEW RICE FOR AFRICA (NERICA) TECHNOLOGY IN HAWUL LGA OF BORNO STATE, NIGERIA

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ABSTRACT

The study assessed the factors affecting the adoption of New Rice for Africa (NERICA) technology in Hawul Local Government Area, Borno State, Nigeria. Eight (8) communities were purposively selected based on their being used by Promoting Sustainable Agriculture in Borno State (PROSAB) for the introduction and promotion of NERICA rice varieties. The study used 160 respondents based on 20 respondents randomly selected from each of the communities. Data for the study was obtained from primary sources obtained through the structured questionnaire administered to the respondents. Both the descriptive and inferential statistics were used to analyze the data collected for the study. Logit regression model was used to analyze the factors influencing adoption of NERICA rice technology, while Tobit regression model was used to analyze the level of adoption of NERICA rice among the respondents. The findings revealed that about 74% of the respondents were 43 years or less. Majority (68%) were male and 32% female; 80% of the respondent were married, while 13% were single. The results also showed that age, household size, household members that helped on farm, farm size, farming experience, distance to market and distance to information on the technology, annual farm income, extension contact, membership of association and farm expenditure were found to influence both the likelihood and the level of adoption of the NERICA technology positively, while sex, marital status and access to credit influenced both the likelihood and the level of adoption of NERICA technology negatively. The study concluded that younger farmers participated more in NERICA rice technology than other older farmers. Farming experience, distance to market and distance to source of information on the technology, extension contact, household members that help on farm, annual income and farm expenditure had influenced both the likelihood of adoption and the level of adoption of the NERICA rice technology positively. It was recommended that The Government/agricultural agencies should work closely with farmers to develop farm technologies that will boost food crop production.

Keywords: Adoption, Africa, Assessment, Rice, Technology.

INTRODUCTION

Adoption of agricultural technologies which lead to increase in farmers' productivity will go a long way in enhancing farmers' output thereby improving their living standard (Idrisa *et al.*, 2012). Rice has long been a staple food in many traditional rice growing communities and in major cities in West Africa. (AfricaRice, 2010). Rice is one of the staple foods in Borno



State and Nigeria in general. It is commonly boiled and eaten with stew or vegetable soup. It is also used in the preparation of several local dishes that are eaten in almost every home especially during festivals and ceremonies (PROSAB, 2008). However, rice production falls short of demand, as Nigeria still depends heavily on rice importation of over five million tons annually, this is valued at \$800 million in scarce foreign exchange. Recently, Federal Government of Nigeria raised the tariff on rice importation to 75% to protect local producers against massive import of rice (PROSAB, 2008).

The New Rice for Africa (NERICA) is a group of high yielding varieties of rice which are also adapted to the tropical climate. There are several cultivars (NERICA 1 to 4 and NERICA- L-41 and -L- 42) of this rice variety introduced into the Promoting Sustainable Agriculture in Borno State (PROSAB) project area. They were introduced to Borno State in 2004 following the intervention of the Canadian International Development Agency (CIDA). CIDA implemented a project (PROSAB) through the International Institute for Tropical Agriculture (IITA) in Borno State. The project promoted the production of a number of crops, including NERICA rice. The NERICA rice has potential of yielding up to eight tons/hectare (PROSAB, 2008). This study therefore, will find out if this technology was adopted and the extent to which the technology is being adopted by the rice farmers in the area.

PROSAB promoted the production of four major crops in the southern part of Borno State from 2004, the programme lasted for five years and was rounded up in 2009. It is necessary to assess the factors influencing and the level of adoption of the technologies introduced into farming communities in order to find out if it was a worthy investment undertaken by the programme. Studies on the adoption of some of the crops (improved cowpea varieties, improved soybean seed technology and improved drought tolerant maize varieties) promoted by PROSAB in the study area have been undertaken. However, it appears that no study on the factors affecting and the level of adoption of NERICA rice has been conducted. This study is therefore, designed to provide information on the factors affecting and the level of adoption of NERICA rice as well as determinants of the adoption of such technology in Borno State.

The purpose of the study was to examine the factors that influence the adoption of NERICA rice as improved agricultural technology among farmers in Hawul Local Government Area, Borno State. The specific objectives were to:

- i. examine the socio economic characteristics of the respondents;
- ii. examine the rate of adoption of the technology among the study communities; and
- iii. identify the factors influencing the adoption of NERICA rice by the respondents;

MATERIALS AND METHODS

The Study Area

The study was conducted in Hawul Local Government Area, Borno State. Hawul Local Government (LGA) is located in the Southern part of Borno State. It lies between latitudes $10^{\circ}15'$ and $10^{\circ}25'N$ and longitudes $12^{\circ}00'$ and $12^{\circ}37'E$. The study area was one of the four (4) Local Government Areas where PROSAB introduced and promoted the production of



NERICA rice varieties, as a major crop. The study area shares boundaries with Biu LGA to the north, Shani and Kwaya Kusar Local Government Areas (LGAs) to the West, Askira Uba Local Government Areas to the east and Adamawa State to the South (Ministry of Land and Survey, 2001). It comprises of Guinea Savanna and Sudan Savanna agro-ecological zones. The study area covers a total land area of 1,856 square kilometers. Based on the 2006 population census, the projected population figure for 2012 was 136,917 and with a population density of 73 persons per square kilometer and growth rate of 2.3% per annum (NPC, 2006).

With regard to agricultural production, the study area is one of the most productive part of the state having annual rainfall ranges from 900mm to 1200mm, lasting for six (6) months (May to October). The vegetation of the area consists of tall growing trees and shrubs. The agro-climatic condition makes the area conducive for rice production. Other common crops grown in the area are maize, sorghum, groundnut, cowpea and pepper.

Sampling Procedure

The study population was the farmers producing NERICA rice varieties in the study area. The list of NERICA rice farmers was obtained from Borno State Agricultural Development Programme (BOSADP) zonal office at Biu. The study area has eight (8) communities: Vina dam, Kwaya Bura, Hema, Marama, Yimirshika, Azare Hawul, Kukurupu and Mbulatawiwi, selected by PROSAB for the introduction and promotion of NERICA rice varieties. These eight (8) communities were purposely selected for the study. Because of the little variation in population of the NERICA rice farmers across the communities, 20 respondents were randomly selected from each of the communities for the study. Thus, 160 respondents were selected for the study.

Method of Data Collection

Two sources of data were used, primary and secondary sources. The primary data were obtained through the use of structured questionnaire administered to the respondents. The secondary information was obtained from records from BOSADP (Biu zone) and IITA publications/records.

Analytical Techniques

Both the descriptive and inferential statistical techniques were used to analyze the data collected for the study. Descriptive statistical techniques namely frequency, means and percentage were used to categorize the respondents based on their socio-economic characteristics. This was used to achieve objective i, ii and iii.

The inferential statistical tools, namely the Logit model and the Tobit model were used to establish determinants of adoption of NERICA rice varieties. Many adoption studies have used the maximum likelihood estimation techniques, to estimate the adoption of technologies (Ouma *et al.*, 2006; Adesina and Zinnah, 1993; Nkonya *et al.*, 2008; and Idrisa, 2009). These techniques are more appropriate than the ordinary least square (OLS) for analyzing the decision to adopt or use technology (Feder *et al.*, 1985). For this study, the Logit model and Tobit model were employed to analyze if there exist a relationship between the dependent variable and the explanatory variables. For the Logit model, the dependent variable is the likelihood of adoption of NERICA. It quantify if a farmer adopts NERICA or not. A farmer is described as an adopter



if he/she devotes at least 30% of his/her rice land area to NERICA varieties as used by Idrisa (2009). It is measured as a binary variable (Dummy). The Logit model is explicitly specified as:

$$\text{ADOPT} = B_0 + B_1 X_1 + B_2 X_2 + B_3 X_3 \dots B_n X_n \quad \dots (1)$$

where;

ADOPT = likelihood of adoption of NERICA rice technology quantified as a dummy (0 or 1 for non-adopters and adopters, respectively)

Adopters = at least 30% of land area = 1

Non-adopters = less than 30% of land area = 0

B_0 = intercept

$B_1 \dots B_n$ = coefficient of the relationship

$X_1 \dots X_n$ = set of independent variables

The equation for the relationship between the socio- economic characteristics, institutional factors and the likelihood of adoption of NERICA among the respondents is given as follows to achieve objective (ii)

$$\text{ADOPT} = B_0 + B_1 X_1 + B_2 X_2 + B_3 X_3 + B_4 X_4 + B_5 X_5 + B_6 X_6 + B_7 X_7 + B_8 X_8 + B_9 X_9 + B_{10} X_{10} + B_{11} X_{11} + B_{12} X_{12} + B_{13} X_{13} + B_{14} X_{14} + B_{15} X_{15} + e \quad \dots (2)$$

where;

ADOPT = Likelihood of adoption, Dummy (1 for adoption and 0 for non-adoption)

X_1 = Age (measured in years)

X_2 = Marital Status (Dummy 1 for married; 0 for otherwise)

X_3 = Sex (1 for Male and 0 for female)

X_4 = Household members (number of individuals in a family)

X_5 = Household members that participated in agricultural activities (number of members that participated)

X_6 = Level of education (numbers of years spent in formal education)

X_7 = Farm size (hectare)

X_8 = Farming experience (Numbers of years in farming)

X_9 = Income (value in Naira)

X_{10} = Farm expenditure (Value in Naira)

X_{11} = Extension contact (Numbers of contacts)

X_{12} = Membership to Agricultural Association, dummy (1 for membership and 0 for non-membership)

X_{13} = Distance to product market (measured in kilometer)

X_{14} = Distance to source of technology (measured in kilometer)

X_{15} = Access to formal source credit (Dummy 1 for access 0 for non-access)

e = Error term



RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

As presented in Table 1, on the average, 74% of the respondents were 43 years and below. This indicates that large number of NERICA rice farmers comprised of relatively young and active farmers. They are likely to be more exposed to knowledge of improved farm technologies and more productive to participate in improved farm technologies. The sex distribution of the respondents shows that majorities (68%) were male and 32% were female. The probable reason for such a very high number of male respondents could be that, the male farmers constitute the household heads and may respond on behalf of the household with an exception where the household head is a female. The distribution of the respondents based on their marital status shows that 80% were married while 13% were single. The significance of marital status can be explained in terms of labor supply.

The distribution pattern of the level of formal education of the respondents indicates that aver 72% of the respondents had secondary education and above, out of which 21% and 6% had OND/ND/NCE and University Degree. This implies that a large proportion of the respondents have appreciable level of formal education. This could give them the ability to perceive, interpret and respond positively to the adoption of technologies. Table 1 show that more than half of the respondents (56%) had the household size of 5 to 10 persons and 8% had household size of 11 to 15 persons. This indicates that a larger proportion of the respondents had more than five persons per household. The importance of household size can be explained in terms of labor supply. The results show that 81% of the respondents had a total land area ranging from 2.0 to 5.0 ha and 13% had from 5.1-9.0ha. This indicates that larger proportion of the respondents cultivated 2.0 ha and above. It implies that many farmers can afford to devote parts of their farm land for the NERICA rice technology in the area.

The results show that a large (96%) proportion of the respondents had ten years of farming experience or more. Out of this, 19% had 21 years to 30 years of farming experience with 10% had 31 years and above. This implies that a very large proportion of the respondents were experienced farmers. With regards to farming experience of the rice technology, the results reveal that 53% of the respondents had three (3) years and above in NERICA rice farming.

The results show that 44% of the respondents earned ₦100, 000.00 to ₦200, 000.00 during the period under study, while 34% earned ₦301, 000.00 and above. This implies that close to half of the respondents earned at subsistent level. The least income earners earned ₦80, 000.00 while the maximum earners earned ₦850, 000.00 with the higher income earners is substantially wide. The results of farm expenditure indicate that majority of the respondents (80%) spent ₦100,000.00 or less on farm expenditure both (labor and agro-chemicals/inputs) while 20% spent ₦15 1,000.00 and above. Farmers who have higher income may have enough to invest in new technologies. The results show that majority of the respondents (53%) has at least three years or more in NERICA production. This study is in conformity with the finding of Orkaa *et al.* (2020).



Table 1: Socio-economic Characteristics of the Respondents (n = 160)

Variables	Frequency	Percentage
Age		
24-43	118	74
44-63	41	25
64 and above	1	1
Marital status		
Single	21	13
Married	128	80
Widow	6	4
Divorced	5	3
Sex		
Male	110	68
Female	50	32
Household size		
Less than 5	58	36
5-10	90	56
11-15	12	8
Level of education		
No formal education	25	16
Primary certificate	20	12
Secondary certificate	72	45
OND/ND/NCE	34	21
Degree	9	6
Farm size (hectare)		
Less than 2	10	6
2-5	129	81
6-10	21	4
Farming experience		
Less than 10 years	6	67
10-20 years	107	19
21-30 years	31	10
31 and above	16	80
Annual income (₦)		
≤ 100,000.00	127	20
100,000 – 200,000.00	32	45
201,000-300,000.00	71	35
301,000 and above	56	10
Total farm expenditure (₦)		
≤ 100,000.000	16	10
101,000 and above	16	10
Years in NERICA production		
Less than three years	75	47
3 years and above	85	53

Source: Field survey (2013)



Rate of Adoption of NERICA rice among the Study Communities

The results (Table 2) shows that 80%, 80%, 65% and 50% of the respondents in Mbulatawiwi, Azare/Hawul, Kukurupu and Hema have devoted at least 30% of their farm land to NERICA rice respectively. This implies that the rice was not highly established in these respective communities. The high rate of adoption in some of the study communities is encouraging. The results also show that larger proportion (53%) of the respondents in the study area have devoted at least 30% of their farm land to NERICA rice technology. The implication of this finding was that the adoption of NERICA rice technology was accepted by the farmers in the various communities of the study area as they devoted substantial part of the farm land to NERICA rice technology. If this trend continues for some years the adoption of NERICA rice varieties will tend to be higher in the area. This study is in line with the finding of Orkaa *et al.* (2020).

Table 2: Rate of Adoption of NERICA rice among the Study Communities (n = 120)

Communities	Adoption rate	Percentage
Vina/Dam		
At least 30% of land given to NERICA	7	35
Less than 30% of land given to NERICA	13	65
Kwaya/Bura		
At least 30% of land given to NERICA	6	30
Less than 30% of land given to NERICA	14	70
Hema		
At least 30% of land given to NERICA	10	50
Less than 30% of land given to NERICA	10	50
Kukurupu		
At least 30% of land given to NERICA	13	65
Less than 30% of land given to NERICA	7	35
Mbulatawiwi		
At least 30% of land given to NERICA	16	80
Less than 30% of land given to NERICA	4	20
Azare/Hawul		
At least 30% of land given to NERICA	16	80
Less than 30% of land given to NERICA	4	20
Marama		
At least 30% of land given to NERICA	8	40
Less than 30% of land given to NERICA	12	60
Yimirshika		
At least 30% of land given to NERICA	9	45
Less than 30% of land given to NERICA	11	55
Total		
At least 30% of land given to NERICA	85	53
Less than 30% of land given to NERICA	75	47

Source: Field survey (2013)



Factors Influence Likelihood of Adoption of NERICA Rice

Table 3 present results show that age, farming experience, distance to source of technology, extension contact and membership of association were significant and positive ($P \leq 0.01$) in influencing the adoption of NERICA technology in the communities. Farm size, education and distance to market were also significant and positive ($P \leq 0.05$), while household members that help on the farm, annual income and farm expenditure were significant and positive ($P \leq 0.1$).

Age tend to determine how active and productive a farmer would be in terms of labor supply. The implication was that as the age of farmer increases to a certain stage, the farmer tend to be more active, experienced and matured to take the right decision and thereby increases the likelihood of adoption of technologies. This may suggest that age influences the decision-making process with respect to exposure to farm information, risk aversion, adoption and participation in technology development. The predominance (74%) of active and productive farmers as earlier observed may have direct bearing on increased availability of able farmers that provide labor, flexibility to participate in new projects, and reduction in the degree of risk aversion tendencies. Farming experience is another factor which positively influenced adoption decision among the respondents. This finding is in line with Olayemi *et al.* (2020) that found that age was found to be significant and positive in adoption of improved farm technology.



Table 3: Likelihood of Adoption of NERICA Rice Technology

Variables	Coef. of variance	Std. Err.	Z	p> Z
Age	-0.2404934	0.0505676	-4.82	0.000***
Sex	0.6831408	0.4417244	1.54	0.187
Marital status	0.1661755	0.3805933	0.44	0.662
Education	0.0530366	0.0121831	5.31	0.014*
Household size	0.2921152	0.1699736	1.72	0.086*
Household size that help on farm	0.5306427	0.2663632	1.99	0.046*
Farm size	0.9100195	0.3160995	2.88	0.004**
Farming experience	0.140493	0.0205676	6.83	0.000***
Distance to market	-0.1178224	0.0346428	-3.40	0.003**
Distance to technology	-0.1304479	0.0306083	-4.26	0.000***
Access to credit	0.7811145	0.5804623	1.34	0.325
Annual income	0.3543245	0.0546354	6.32	0.021*
Extension contact	0.1093228	0.0249971	4.37	0.000***
Membership to association	0.0620622	0.0142754	4.35	0.000***
Farm expenditure	0.2646415	0.1519869	1.74	0.085*
Constant	1.553762	0.4760976	3.25	0.000
Log likelihood	- 55.786836			

*** = significant at 1%, ** = significant at 5% and * = significant at 10%

Source: Field survey (2013)

The results (Table 3) also shows that extension contact was positive and significant in influencing the adoption of NERICA rice in the study area. Contact between the extension agents and farmers is an opportunity for exchange of idea between extension workers and farmers. Membership of farmers association was also positive and significant ($P \leq 0.01$) in influencing the adoption of the technology among the respondents. Membership of farmers associations enhances farmers' social capital and understanding, thereby allowing trust and information exchange among members.

Education was also found to be significant and positive in influencing the likelihood of adoption of NERICA rice among the respondents ($P \leq 0.05$). This explains the importance of education in influencing the adoption of farming technologies. Farm size was found to be significant and positive ($P \leq 0.05$) in influencing the adoption of NERICA rice among the respondents. This means that farmers with large farm size had higher likelihood of adopting the technology rice compared to farmers that had smaller farm size. Distance to market and distance to source technology are important factors in adoption decision they gives farmer easy access to purchase farm inputs and equally sell their farm produce. The results show that



distance to market and distance to source technology was significant and negative ($P \leq 0.05$ and $P \leq 0.01$) in influencing adoption of the technology. This signifies that distance to market and source of technology had influence on the adoption decision of the respondent negatively. Farmers' closeness to markets and source technology enhance their accessibility for the purchase/sale out both farm inputs and farm produce. These may also increase their likelihood of adoption of the NERICA technology.

CONCLUSION AND RECOMMENDATIONS

It was concluded that younger farmers participated more in NERICA rice technology than other older farmers. Farming experience, distance to market and distance to source of information on the technology, extension contact, household members that help on farm, annual income and farm expenditure had influenced both the likelihood of adoption and the level of adoption of the NERICA rice technology positively. However, age, sex, marital status, and access to credit were found to influence the adoption of NERICA rice negatively. The high rate of adoption across the study communities were Mbulatawiwi, Azare/Hawul, Kukurupu and Hema. The Government/agricultural agencies should work closely with farmers to develop farm technologies that will boost food crop production. The Government/agricultural agencies should employ more educated extension workers and redeployed them to the farming communities, provide adequate incentives for better service delivery and that training and retraining should be organized on a regular bases for effective service delivery.

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