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ADOPTION DETERMINANTS OF IMPROVED RICE PRODUCTION TECHNOLOGIES IN JEMA'A, LOCAL GOVERNMENT AREA, KADUNA STATE, NIGERIA

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ABSTRACT

The study examined adoption determinants of improved rice production technologies in Jema'a LGA, Kaduna State. To this end, 120 rice farmers were randomly selected comprising adopters and non-adopters. Structured questionnaire was used to illicit information from the respondents. Descriptive statistics, adoption index and probit regression model were used to analyze the data collected. The results revealed that majority (55.0%) of the adopters were between 21-40 years of age while majority (51.6%) of the non adopters were between 21-40 years of age. Also majority (78.3%) of both adopters and non-adopters were male. A large proportion (53.3%) of the adopters had household size of between 5-10 people while 73.4% of the non-adopters had household size of less than 5 people. Large proportion of the adopters were literate while a considerable percentage of the non-adopters had no formal education. Majority (53.3%) of the adopters were members of farmers cooperative while just (33.3%) of the non-adopters belonged to farmers cooperative. Majority (50.0%) of the adopters has farming experience of 10-20 years while just (31.7%) of the non-adopters has farming experience of 10-20 years. Also 98.3% of both adopters and non-adopters owned their land. The rate of adoption of improved rice varieties was 66.7%.. The major adoption determinants of improved rice production technologies include: age ($p<0.01$), farm size ($p<0.05$), marital status ($p<0.10$), extension contact and labour ($p< 0.05$). The major constraints faced by the adopters were soil problem, availability of fertilizer, birds'

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invasion, flooding and lack of credit facilities. The rice farmers in the study area should be sensitized and mobilized to key into the federal government agricultural transformation progamme.

Keywords: Adoption, rice, varieties, improved technologies, production

INTRODUCTION

Agriculture is one of the major sub-sectors of Nigeria economy. It account for about 40 percent of the nation's Gross Domestic Product (GDP) and employ about two-third of the labour force (NBS, 2008). This sub-sector also play significant role as major source of food, provision of foreign exchange earnings and industrial raw materials for the agro-based industries.

Rice (Oryza stiva) is an annual crop and one of the most important staple food crop grown in tropical counties. The crop is a staple food for about half of the human race. It is the major cereal crop which can be cultivated in the standing water of flats, low-lying tropical soils (Mustapha *et al.,* 2012). It is most important cereals after wheat. There is rarely any country in the world that rice is not utilized in one form or the other. In Nigeria rice is one of the few food crops whose consumption has no cultural, religious, ethnic or geographical boundary (Samson *et al. (*2007).

WARDA (2003) projected sharp increase in rice consumption for Nigeria as high as 4.5 percent per annum. Mustapha *et al.* (2012) explained that only about 67 percent of the 25 million hectares of land cultivated to various food crops were cultivated to rice between the year 2000 and 2002 and throughout this period rice output increased considerably but subsequently decreased. Dontsop *et al.* (2010) stated that in 2009 Nigeria has an estimated annual rice demand of 5 million tonnes but the country could only produce about 2.21 million tonnes resulting in rice supply and demand gap of 2.79 million tonnes. This gap was expected to be bridged by importation and this constituted a serious drain on the nation's foreign exchange (NRDS, 2009).

In this respect, several efforts have been made t o improve rice production in Nigeria. Most of these efforts according to Wopereis *et al.* (2008) are aimed at addressing the wide supply and demand gap in rice production in order to attain self-sufficiency as well as reduce the huge import bills on rice. According to World Bank (2008) the adoption of new or improved agricultural technologies, like high yielding varieties (HYV) could assist in bringing about significant increase in agricultural productivity and stimulate a transition from low productivity subsistence agriculture to a high productivity agro-industrial status. This study therefore examined the determinants of adoption of improved rice production technologies among small-scale farmers in Jema'a Local Government Area, Kaduna State. The specific objectives are to: describe the socio-economic characteristics of the small scale rice farmers, examine the rate of adoption of improved rice varieties by the farmers, determine the factors that influence adoption of improved rice production technologies in the study area and identify the constraints faced by the rice farmers.

MATERIALS AND METHOD

This study was carried out in Jema'a Local Government of Kaduna State. The Local Government Area (LGA) lies between latitude 9°11'North to 9°30'North and longitude 8°00'East to 8°30'East. The LGA covers an estimated land area of 1,661km^2 (Wikipedia, 2013). The total human population as at 2006 census is 278,735 (NPC, 2006). The mean annual maximum and minimum temperatures are 30°C and 24°C, and annual rainfall of 1200mm 1700mm. The soils are mixture of fine sand and clay which have been described as sandy loam. Major tribes include; fantswan, kagoro and katuf. Major crops grown are rice, cassava, ginger, sorghum, maize, cowpea and yam. Major livestock reared include; pig cattle, goats, sheep and poultry.

Multistage sampling technique was used to select the respondents. Jema'a LGA was purposively selected due to its predominant rice production activities. The second stage involved random selected of three (3) districts. The third stage was random selection of four (4) villages per district, totaling twelve (12) villages. The fourth stage involved random selection of ten (10) rice farmers from each village that is five (5) adopters and five (5) non-adopters which gave a total of 120 respondents (3x4x10 = 120 rice farmers, 60 adopters and 60 non-adopters).

Structured questionnaire and personal interview were used for the data collection. Two separate questionnaires were administered to the respondents (adopters and non-adopters) by trained enumerators. Data collected were analyzed using simple descriptive statistics, adoption index and probit regression model. The adoption index was estimated for each of the major rice varieties cultivated in the study area and subsequently for the local and improved rice varieties in the study area. In this respect, adoption index was computed for individual farmers. A similar approach was used by Philip *et al.* (2000) and Saka *et a l.* (2005) whereby adoption index (Q_x) is given by:

$$Qx = \frac{\sum_{k=1}^{n} Sk}{\sum_{k=1}^{n} ST}$$

Where;

Q_x = the adoption rate of rice variety u

S_k = Land area grown to rice variety u by farmer k

S_T = Total land area grown to rice by farmer k

K = (1--------n).

A probit model was used to determine the factors which influence the adoption of improved rice production technologies in the study area. The model was implicitly expressed as;

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10})$$

The explicit form of the model is;

$$Y = a + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_4X_5 + \text{-----} + B_{10}X_{10} + ui$$

Where;

Y = Adoption index (1 if adopted, 0 otherwise)

X_1 = Age of farmers (years)

X_2 House hold sixe (number of people)

X_3 = Educational level (years spent schooling)

X_4 = Farming experience (years)

X_5 = Farm sixe (Ha)

X_6 =Cooperative member ship (1 if member, o otherwise)

X_7= Marital status (1 married, 0 otherwise)

X_8 =Tenancy status (1 land owned, 0 otherwise)

X_9 = Extension contact (number of contacts)

X_{10} = Labour (man days)

a = Constant

Ui = Error term

RESULTS AND DISCUSSION

Scio-economic Characteristics

The results in Table 1 revealed that majority (55.0%) of the adopters were between the ages of 21-40 years while (51.6%) of the non-adopters were between 21-40 years, 30% of the adopters were between 41-50 years while 26.7% of the non-adopters were between 41-50 years. The adopters have average age of 34.2 and non-adopters have average age of 31.0. This implies most of the rice farmers in the study area were in their active productive age. This corroborate findings of Agwu (2004), that young age of a farmer is an advantage since they are physically able and more mentally alert to learn new technologies than the older farmers.

Table 1 also reveals that majority (78.3%) of the adopters and non-adopters were male while a proportion (21.7%) of the adopters and non adopters were female. This implies farming was mostly carried out in the study area by men; this may be connected to the fact that in some African rural communities women were not allowed to participate in some aspect of farming. This is in line with the findings of Mustapha *et al.* (2012) that participation of female in farming in some local communities was minimal due to the fact that their cultural belief does not permit full participation of women in farming. The result further revealed that majority (53.3%) of the adopters has household size of between 5-10 people and average of 9 people while about (73.4%) of the non-adopters has household size of less than 5 people and average household size of 6 people. The relatively large household size of the adopters could serve as advantage since it may likely enable the adopters to use family labour, thereby reducing m labour cost required in the adoption of improve production technologies (Agwu, 2004).

Results in Table 1 also revealed that 23.3% of the adopters had no formal education, 36.7%, 23.3% and 16.7% of the adopters had primary, secondary and tertiary education respectively. Meanwhile, 18.3% of the non-adopters had no formal education while 46.7%, 20.0%, and 15.0% of the non-adopters had primary, secondary and tertiary education respectively. This implies that the farmers in the study area were averagely educated. This average level of literacy was expected to have positive influence on their decision to adopt improved rice production technologies. About 53.3% of the adopters were members of farmers' cooperative association while just 33.3% of the non adopters were members of cooperative association. This implies that majority of the farmers in the study area that has adopted improved rice production technologies were members of cooperative association. The membership of farmer cooperative association can serve as a medium for extension contact with large member of farmers and can also offer opportunities for participatory interaction with extension organizations (Peterson, 1997).

Also, about 25.0% of the adopters had farm size of less than 2 hectares while 35.3% of the non-adopters had less than 2 hectares of farm size. Meanwhile majority (75.0%) of the adopters has farm size of 2 and above 5 hectares and about 35.0% of non-adopters has farm size of 2 and above 5 hectares. This implies that majority of the adopters cultivate relatively larger hectares of land than the non-adopters and this can be perceived as advantage for adoption of improved farming practices.

Results further revealed (Table 1) that 45.0% of the adopters, has less than 10 year of farming experience, about 65.0% of the non-adopters has experience of less than 10 years. However, majority (50.0% of the adopters has farming experience of 10-20 years while 31.7% of the non-adopters has farming experience of 10-20 years. This implies that majority of the adopters had

long period of farming experience, hence this could increase their level of acceptance of new ideas as a means of increasing production.

The results further indicate that majority (98.3%) of both adopters and non-adopters owned the land they cultivate. This is a common characteristic of most African small scale farmers who owned the land they cultivate. This substantiate the findings of Abu *et al.*(2011) who stated that the impact of socio-economic factors on adoption of improved farm practices in Nigeria tends to be higher among farm land owners than tenants. Table 1 also showed that majority (83.3%) of the adopters had extension contact and about (55.0%) of the non-adopters had extension contact. This implies that extension service in the study area was relatively high. This can have advantage of adoption of improved rice production technologies.

Adoption Rate

Table 2 shows estimated adoption rate of different rice varieties identified in the study area. This indicated that a considerable proportion of land area grown to rice was cultivated to improved rice varieties with adoption rate of 66.7% while the adoption rate for the local varieties was estimated at 33.2%.

However, the improved rice varieties cultivated by the farmers, NERICA was the most dominant with estimated rate of 23.9% and 34.9%, followed by FARO 49 with adoption rate of 23.9% and FARO 45 with adoption rate of 7.9%. On the other hand, among the local varieties grown in the study area; Danruwa was the most dominant with estimated adoption rate of 12.0% followed with a wide difference, Jankara with adoption rate of 6.7%, Marasanda 5.5%, Mainasa/Guntu 4.6% and Jonatan 4.4%. This implies that there was high adoption rate of improved rice varieties among the farmers in the study area, though local varieties were still grown side by side with the

improved varieties. The high rate of adoption can be attributed to the farmers' desire for high yields, increased income and improved well being.

Factors determining Adoption of Improved Rice Production Technologies

The results from the probit regression model used to determine the factors influencing the adoption of improved rice production technologies in Jema'a LGA, Kaduna state (Table 3). The Chi-square of 409.341*** significant at 1% level indicates the model fitted. However, five (5) variables were found to be statistically significant. These include, the age, farm size, marital status, extension contact and labour. Age (X_1) was found to significantly ($p<0.01$) determine the adoption of improved rice production technologies in the study area. As the age of a farmer progresses so also his/her experience in farming and was likely to adopt improved farming practices. The negative coefficient is of course unexpected. Farm size (X_5) is also a significant determinant of adoption of improved rice production technologies in the study area. This was statistically significant ($p<0.05$). The positive coefficient indicates that the larger the farm size of a, the positive is his/her decision to adopt improved farming techniques. This substantiate the findings of Saka *et al.* (2005) that decision whether or not to cultivate improved rice varieties is determined by the size of rice farm. Marital status (X_7) also statistically significant ($p<0.10$) though at lesser extent determine farmers' decision to adopt improved crop production technologies in the study area. This can be connected to their desire to reliaze high yield and have surplus to sale to meet their family expenses. Extension contact (X_9) significantly ($p<0.05$) influence farmers decision to adopt improved farming practices in the study area. This implies that famers with more contact with extension agents were likely to become more aware of existence of improved farming practices and the advantages therein. This has positive coefficient indicating that the frequency in contact with extension agents, the increase in farmers' decision

to adopt innovation. This is also in line with the findings of Saka *et al.* (2005) who stated that farmers' decision to adopt improved farm practices is determined by frequency of extension contact. Labour (X_{10}) significantly determine adoption of improved rice production technologies at 5% level. And it has positive coefficient which indicate that the more availability of cheap labour, the more desire farmers will have in adopting improved rice production technologies in the study area.

Rice Farmers' Constraints

The results in Table 4 revealed that the major constraints of the adopters of improved rice production technologies in the study area were soil problem this was ranked as the most serious problem to the farmers. It was followed by unavailability of fertilizer which ranked 2nd, bird invasion and flooding ranked 3rd. lack of credit facilities and high cost of improved inputs ranked 4th and 5th respectively. On the other hand, the non-adopters of improved rice production technologies in the study area, admitted that high cost of improved inputs to be the most critical constraint, which ranked 1st, soil problem, flooding and bird invasion ranked 2nd, 3rd and 4th respectively as constraints that deter them adopting improved rice farming practices. Meanwhile, lack of credit facilities and unavailability of fertilizers ranked 5th and 6th as constraints be deviling their decision to use improved practices.

CONCLUSION

The study found the rate of adoption of improved rice varieties to be high in the study area. The major adoption determinants were age, farm size, marital status, extension contact and labour. The major constraints likely to impede high rice output in the study area were soil problem,

unavailability of fertilizer, birds' invasion and lack of credit facilities. However, the most serious constraints that marred the effort of non adopters to adopt improved farming practices were high cost of improved inputs. Therefore, in order to ensure self-sufficiency in rice output in the study area, Kaduna state and Nigeria at large, there is need to sensitize and mobilize the farmers to key into the federal government agricultural transformation programme.

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Table 1. Distribution of respondents by socio-economic characteristics

Socio-economic variables	Adopters			Non-Adopters		
	Frequency	Percentage (%)	Mean	Frequency	Percentage (%)	Mean
Age (years)						
<21	5	8.3		6	10.0	
21-30	17	28.3		11	18.3	
31-40	16	26.7	34.2	20	33.3	
41-50	18	30.0		16	26.7	31.0
>50	4	6.7		7	11.7	
Total	**60**	**100**		**60**	**100**	
Gender						
Male	47	78.3		47	78.3	
Female	13	21.7		13	21.7	
Total	**60**	**100**		**60**	**100**	
Marital status						
Married	52	86.7		51	85.0	
Not married	8	13.3		9	15.0	
Total	**60**	**100**		**60**	**100**	
Household size(no)						
< 5	12	20.0		10	16.7	
5-10	32	53.3	9	44	73.4	

11-15	10	16.7	2	3.3
16-20	4	6.7	2	3.3
>21	2	3.3	21	3.3
Total	**60**	**100**	**60**	**100**
Educational level				
Formal education	14	23.3	11	18.3
Primary	22	36.3	28	46.7
Secondary	14	23.3	12	20.0
Tertiary	10	16.7	9	15.0
Total	**60**	**100**	**60**	**100**
Cooperative membership				
Member	32	53.3	20	33.3
Not member	28	46.7	40	66.7
Total	**60**	**100**	**60**	**100**
Farm size (Ha)	15	25.0	25	41.7
2-5	29	48.3	20	33.3
>5	16	26.7	15	25.0
Total	**60**	**100**	**60**	**100**
Experience (years)				
<10	27	45.0	39	65.0
10-15	22	36.7	10	16.7
16-20	8	13.3	9	15.0

>21	3	5.0	2	3.0
Total	**60**	**100**	**60**	**100**
Tenancy status				
Owned	59	98.3	59	98.3
Not owned	1	1.7	1	1.7
Total	**60**	**100**	**60**	**100**
Extension contact				
Contact	50	83.3	33	55.0
No contact	10	16.7	27	45.0
Total	**60**	**100**	**60**	**100**

Source: Field survey, 2012

Table adoption index for improved and local rice varieties cultivated in the study area

Variety	Land Area (Ha)	Adoption Coefficient
Improved		
NERICA	64.83	0.349
FARO49	44.37	0.239
FARO 45	14.75	0.079
Total	**123.95**	**0.667**
Local		
Danruwa	22.33	0.120
Jankara	12.45	0.067
Marasanda	10.25	0.55
Mainasa	8.50	0.046
Jonatan	8.25	0.044
Total	**61.78**	**0.332**

Source: Field survey, 2012

Table 3: Probit regression estimate of adoption determinants of improved rice production technologies.

Variables	Estimated coefficients	Std Error	z-value
Age (x_1)	-0.089	.024	-3.648***
Household size (x_2)	0.051	.041	1.256
Years of schooling (x_3)	0.001	.066	0.010
Farming exp (x_4)	0.075	.024	3.110**
Farm size (x_5)	0.185	.149	-1.236
Cooperative memb. (x_6)	-0.582	.302	-1.927*
Marital status (x_7)	0.122	.420	-0.289