LEVELS OF ADOPTION OF NERICA RICE TECHNOLOGIES IN SOUTHWESTERN, NIGERIA

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ABSTRACT
This study examined levels of adoption of upland NERICA technologies in Southwestern Nigeria. A four-stage sampling procedure was used to select three states (Ekiti, Ogun and Ondo states) and four hundred and forty-four (444) rice farmers used in this study. A structured interview schedule was used to collect data on personal and enterprise characteristics, and adoption stages. Data were analysed using frequency, percentages, mean, and correlation at 0.05 significance level. The result revealed that the mean age was 49.60years with majority (82.20%) being male and 63.50% of the growers cultivated 0.40-1.59 ha with mean yield of 0.60 t/ha and N231,295.38±182,372.02 revenue. Adoption level of upland NERICA technologies was low (56.3%) in the study area. The upland NERICA seed technology was at the trial stages of adoption. Level of adoption was significantly influenced by farm income ($r=0.40$; $p\leq 0.05$) and farming experience ($r=0.02$; $p\leq 0.05$). Adoption of NERICA was inadequate. The study recommended that government should provide modern communication infrastructure and build capacity of extension agents to deliver specific information at different adoption stages to farmers in order to upscale rice production.
Keywords: NERICA, adoption stages, rice technologies, adoption level

INTRODUCTION

Rice is an important crop for accelerating agricultural development in Nigeria. It is one of the crops currently recognised for driving the economy of the country. The current statistics indicate annual consumption rate as 6.50 million tonnes and the average production as 4.95 million tonnes leading to a shortfall of 1.55 million tonnes in production – consumption of rice annually in Nigeria (United States Department of Agriculture, USDA, 2018). This shortfall is being augmented by importation which constitutes a significant share of the agricultural imports. Food security of most importing countries is adversely affected by a sudden rise in food prices in international markets. There is the urgent need to increase production of rice to meet rising local demand as well as exporting capacity to drive economic growth. The increasingly limited room for expansion of cultivated crop as a result of population growth is paving way for advancement of technology which enhances crop yield per unit area.

One of the outcomes of technology advancement in recent times is New Rice for Africa, NERICA. There is a general consensus that adoption of high yielding technologies such as NERICA can greatly increase rice production. NERICA was developed deliberately with inbuilt attributes superior to the existing technologies. This was greatly achieved from the cross between Asian rice (*Oryza sativa* L.) and African rice (*Oryza glaberrima* Seud.) which combine the yield – related attributes and the adaptability to Africa geographical conditions of the two lines (Africa Rice Center, ARC, 2012). Farmers desire such attributes as high yielding, low inputs, drought tolerance and compatibility with their low income status to improve their livelihood. These traits are specifically bred in NERICA varieties to combat the previous challenges attributed to raising rice production in upland rain-fed ecology.

Nigeria was a key player in the Multi-national NERICA Dissemination Project (MNRDP) which was initiated by African Rice Initiative in 2002, to improve access to NERICA varieties thereby enhancing rice production (Kane, Djiro, Sy, and Shane, 2012). Moreover, government partnered with states through the Anchor Borrowers' Programme (ABP) to make fund available, facilitate access to inputs and provide linkage between farmers and market channels to promote adoption of NERICA technologies (Central Bank Nigeria, CBN, 2016). The evaluation of the MNRDP conducted in 2010 revealed that adoption of NERICA varieties was below average in Nigeria (Africa Development Bank, ADB, 2014). Government's efforts at bridging the production–consumption gap appears not to be yielding the expected result. In essence, NERICA technology was inadequately adopted which follows the low adoption trend of most agricultural technologies in Nigeria. The reasons for low adoption of profitable agricultural technology remain a challenge in research. The variation in farmers' nature as it relates to their diverse farming systems tends to affect adoption decision process.

Although, studies on rates of adoption of NERICA varieties have been explicitly conducted in Nigeria (Tiamiyu, Akintola, and Rahji, 2009; Ojehomon, Adewumi, Omotesho Ayinde, and Diagne, 2012 and Awotide, 2015). However, intricacies surrounding low adoption of NERICA have not been clearly documented. Equally, information on levels of adoption of upland NERICA technologies is inadequate. The purpose of this study therefore, was to examine levels of adoption of upland NERICA technologies in

Southwestern, Nigeria. In line with the foregoing, the specific objectives of this study were to:

1. describe the personal characteristics of rice farmers in the study area;
2. examine the enterprise characteristics of rice farmers in the study area;
3. identify the stages of adoption of upland NERICA production technologies in the study area;

METHODOLOGY

The study was carried out in Southwestern Nigeria. The region lies between 3°E and 6°E of the longitude and latitude is between 6°N and 9°N. It has the second largest population out of the six geopolitical zones in Nigeria, comprising about 25 million people who are predominantly farmers (National Bureau of Statistics, 2011). The Southwestern region is one of the major players in rice production (Gyimah-Brempongi, 2011).

The target population comprised all the rice farmers. Data collection was organised using a four–stage sampling procedure. Three states (Ekiti, Ogun, and Ondo states) were purposively selected from six states present in the region, for their participation in the MNRDP. Seventy per cent of Rice Growing LGAs (RGLGAs) were randomly selected from ten, five and four RGLGAs of Ekiti, Ogun and Ondo states, respectively, and 50% of the 68 Rice Growing Communities (RGCs) from each of the selected RGLGAs and 70% of the total sample frame of 634 were randomly selected. Explicitly, 184, 180 and 80 rice farmers were selected from Ekiti, Ogun, and Ondo states, respectively. Thus, a total of 444 rice farmers were used for this study. Information was sourced through the use of a structured interview schedule which was validated by judge method and adjudged reliable at r= 0.89.The interview was conducted by the researcher and trained enumerators in a cross sectional survey. Level of adoption of upland NERICA technologies was measured based on adoption continuum of awareness, interest, evaluation, trial and adoption or use and were scored 1, 2, 3, 4 and 5, respectively. A list of eight recommended upland NERICA technologies such as NERICA seed technology; land preparation, seed treatment, planting method, spacing, weeding, fertiliser application and pests /diseases management was presented to the farmers and were asked to mark which of adoption continuum they were. Hence, a farmer that had adopted all the components of the upland NERICA technology package was scored 8. Using the mean, adoption level was established by categorising adoption index as farmers whose adoption scores ranged between the mean and the maximum score as having high adoption, while farmers with scores below the mean were regarded as having low adoption. Descriptive statistics, such as frequency, percentages, and mean were used to describe selected personal and enterprise characteristics, adoption stages and levels of adoption. Inferential statistics as Pearson Product Moment Correlation, PPMC and Chi-square was applied to determine the relationship between selected personal characteristics based on the level of measurement.

RESULTS AND DISCUSSION

Table 1 shows the distribution of rice farmers according to selected personal characteristics. The age category of a large proportion (41.2%) the rice farmers was between 50-59 years with the average of 49.6 years. This age is regarded as productive age implying the possession of physical strength to carry out farming activities. This corroborates the finding of Ogundele and Okoruwa (2006) that rice farmers are of productive age. However, the average age of about 50 suggests a decline in productivity with weaning vigour and thus needs the inducement of the younger ones for improved productivity. Most (82.2%) of the rice farmers were male and only 17.8% were female suggesting more male than female in rice production. Awotide, (2015) reported similar results that rice production is male dominant. A large percentage (95.0%) of the rice farmers was married which described them as responsible individuals with family to care for. Majority of rice farmers (77.9%) had formal education leaving only 22.1% with no formal education implying the prevalence of high literacy level among the rice farmers. This finding agrees with the report of Awotide, (2015) where high level of literacy was found among the rice farmers in the Southwestern Nigeria. Many were Christians (59.2%) while (38.7%) were Muslims. It implies that rice production is popular among the two religions suggesting no religion barrier in NERICA adoption. Similarly, majority (64.2%) of the households had between 5 and 9 persons with an average of 6 people. This household size is considered to be fairly large. This finding is consistent with Ojo, Dimelu, and Okeke *(*2011) who reported a large household size of 7 members as being prevalent in Ekiti State. Farmers rely to a large extent, on household members for supply of farm labour due to their poor income status. Almost half (49.8%) belonged to farmers' groups while 49.1% were members of other social organisations. It implies that rice farmers are members of farmers' organisations which agrees with the report by Olajide and Oyebode (2014) that the new method of extension outreach emphasises the passing on of agricultural technologies to farmers in organised group.

Table 1: Distribution of respondents by personal characteristics N=444

Variable	Frequency	Percentage	Mean/Sd
Age (years)			
20 - 29 years	1	0.2	
30 - 39 years	45	10.1	
40 - 49 years	167	37.6	
50 - 59 years	183	41.2	
60 - 69 years	46	10.4	
70 - 79 years	2	0.5	49.60±8.10
Sex			
Male	365	82.2	
Female	79	17.8	
Level of Education			
No formal Education	98	22.1	
Primary School Education	192	43.2	
Secondary School Education	127	28.6	
Tertiary Education	27	6.1	
Religion Affiliation			
Christianity	263	59.2	
Islam	172	38.7	
Traditional	9	2.0	
Household size			
< 5	131	29.5	
5-9	285	64.2	
10-14	24	5.4	
15-19	4	0.9	5.73±2.38
***Social Organisations**			
Rice farmers' groups	221	49.8	
Community associations	176	39.6	
Community security groups	56	12.6	
Cooperative Groups	141	31.8	

Source: Field survey, 2016; * Multiple responses were recorded

Rice farmers' enterprise characteristics

Table 2 shows the distribution of rice farmers by their enterprise characteristics. A substantial percentage (68.9%) of the rice farmers possessed between 11 and 30 years' experience in rice production. This implies that farmers are well experienced in rice production. Ainembabazi and Mugisha (2014) established that farming experience tends to improve knowledge about adoption of new technologies. Annually, 32.4% of the rice farmers earned less than ₦100,001.00 income in the study area. It suggests that rice farmers derive relatively low income from rice farming and may therefore be considered as poor. Financial capital is an important factor in enabling the adoption of new technology. Majority of rice farmers (63.5%) cultivated between 0.40 to 1.59 hectares describing them as small scale farmers. The finding corroborates the finding of Awotide (2015) that the production scale range of 0.1 to 5.9 ha was prevalent. Rice farmers with large farms have access to economy of scale which facilitates better production management and serves as incentive for adoption of new technologies. The yield recorded for the majority (80.2%) was below 1001kg/ha. This amounts to low yield compared to the NERICA yield potential of 2.5 to 3.0kg/ha in upland ecologies. This corresponds with the finding of ADB, (2014) where low yield of 1-1000kg/ha was obtained for upland NERICA varieties.

Adoption stages of upland NERICA technologies

Table 3 shows the distribution of respondents by stages of adoption in the study area. The result revealed that NERICA production technologies such as land preparation ($\bar{x}$= 2.95), seed treatment ($\bar{x}$= 2.68), planting method ($\bar{x}$= 2.68), spacing ($\bar{x}$= 2.73), weeding ($\bar{x}$= 2.73) and fertiliser application ($\bar{x}$= 2.90), pests and diseases management ($\bar{x}$= 2.65) were at the evaluation stage with the mean score of almost 3.00 while only the NERICA seed ($\bar{x}$=3.69) was at the trial stage with the mean score nearly 4.00. This implies that farmers adopt NERICA technologies in different combinations suggesting the prevalence of technology component adoption among the rice farmers in the study. This might be attributed to the possibility that rice farmers find certain NERICA technologies suitable to their farming practices and adopt those ones. This finding is consistent with the reports by Laether and Sonde (1991) and Ogundele and Okoruwa (2006) that farmers adopt technologies in sequential order, adopting simple or

cheap technologies before moving to the more complex or expensive ones.

Table 2: Distribution of respondents by enterprise characteristics N=444

Variable	Frequency	Percentage	Mean/Sd
Farming experience			
1 to 10 years	135	30.4	
11 to 20 years	212	47.7	
21 to 30 years	81	18.2	
31 to 40 years	13	2.9	
>40 years	3	0.7	15.92±8.62
Farm income			
< 100001	144	32.4	
100001- 100000	119	26.8	
200001- 300000	73	16.4	
300001- 400000	53	11.9	
400001- 500000	21	4.7	
500001- 600000	19	4.3	
600001- 700000	5	1.1	
700001- 800000	3	0.7	
> 800000	4	0.9	231295.38±182372.02
Farm holding			
< 0.40	4	0.9	
0.40-1.59	282	63.5	
1.60-2.79	78	17.6	
2.80- 3.98	37	8.3	
3.99- 5.17	35	7.9	
> 5.17	8	1.8	1.25±0.97
Yield			
< 1001	356	80.2	
1001-2000	59	13.3	
2001-3000	16	3.6	
3001-4000	8	1.8	
4001-5000	5	1.1	601.82±977.77

Source: Field survey, 2016

Table 3: Distribution of respondents by stages of adoption of upland NERICA technologies N=444

NERICA technologies	Stages of adoption					
	A %	I %	E %	T %	A %	$\bar{x}$
Seed	11.30	4.30	19.40	34.20	30.80	3.69
Land preparation	44.60	5.60	1.80	6.10	41.9	2.95
Seed treatment	50.00	9.00	1.10	3.20	36.70	2.68
Planting method	52.70	1.80	4.10	7.20	34.20	2.68
Spacing	50.5	2.30	5.00	8.60	33.80	2.73
Weeding	50.90	3.80	3.40	4.70	37.20	2.73
Fertiliser application	45.70	5.20	2.00	7.70	39.4	2.90
Pests and diseases management	53.80	2.50	2.70	7.20	33.80	2.65

Notes: Multiple responses; A: Awareness; I: Interest; E: Evaluation; T: Trial; A: Adoption
Source: Field survey, 2016

Adoption of upland NERICA technologies

Table 4 shows the distribution of respondents by the adoption of upland NERICA technologies. The result revealed that 31.53% of the rice farmers adopted NERICA technologies suggesting low cultivation of upland NERICA in the study area. This finding agrees with ADB (2014) that cultivation of NERICA technologies was low in Nigeria. The estimated value for adoption recorded by ADB 2014 was 43.00% against the potential adoption of 63.00%). The value of adoption of NERICA technologies estimated by ADB was 31.53% recorded in this study may further established the possibility that the farmer who adopted in the past may have discontinued to plant NERICA and reverted to cultivate the traditional varieties. This may be as a result of certain constraints such as lack of access to market, inputs, and insufficient information regarding the planting of NERICA varieties.

Table 4: Distribution respondents by adoption of upland NERICA technologies N=444

Adoption of NERICA Technologies	Frequency	Percentage
Yes	140	31.53
No	304	68.47

Source: Field survey, 2016

Levels of adoption of upland NERICA technologies

Figure 1 shows the distribution of rice farmers by the levels of adoption of upland NERICA technologies. Low level of adoption (56.3%) was observed at the study area. The low adoption probably explains the low yield recorded among the rice farmers (Table 2). The implication is that adoption of upland NERICA is marginal compared to the high level of adoption expected. This finding agrees with the one reported by Adedeji, Nosiru, Akinsulu, Ewebiyi, Abiona, Jimoh (2013) that low level of adoption of upland NERICA technologies was observed among the paddy rice farmers in Kaduna State, Nigeria.

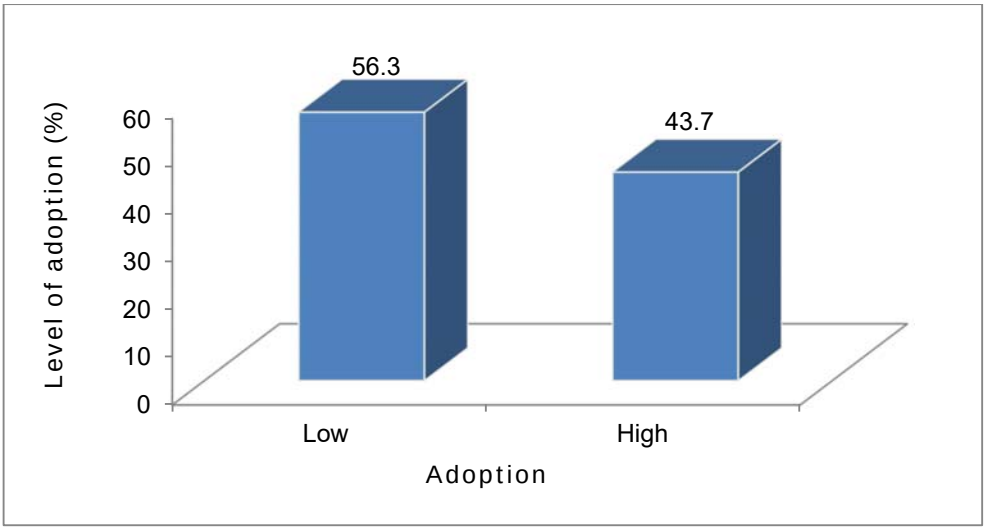

Figure 1: Distribution of respondents by levels of adoption
Source: Field survey, 2016

Hypothesis one

The result of the chi-square test between selected personal characteristics and levels of adoption is presented in Table 5. The result revealed that educational level (χ^2=49.44; p≤ 0.05), religion (χ^2= 32.79; p ≤0.05) and membership of social organisation (χ^2=9.96; p≤ 0.05) were significantly associated with levels of adoption of upland NERICA technologies. Faturoti, Emah, Isife, Tenkoano, and Lemchi (2006) established a positive relationship between exposure to formal education and adoption. Religious affiliation is significantly related with adoption suggesting that religion has influence on adoption of NERICA technologies. Farmers who are members of social organisations would be more likely have high adoption level than farmers who are not.

Table 5: Chi-square analysis of association between some selected personal characteristics and levels of adoption of upland NERICA technologies

Variable	Chi square value	df	p-value
Religion	32.79	2	0.00
Level of Education	49.44	3	0.00
Membership of social Organisation	9.96	1	0.00

Source: Field survey, 2016.

Correlation analysis between selected personal characteristics and levels of adoption of upland NERICA technologies

Correlation analysis of selected personal characteristics of the rice farmers and levels of adoption is presented in Table 6. The result shows that farm income ($r = 0.40$; $p \leq 0.00$) was positive and significant, whereas years of farming experience ($r = -0.02$; $p \leq 0.00$) was negative and significantly related to levels of adoption. Higher profit as a result of adoption tends to lead to more adoption. This agrees with the report by Marra, Pannell, and Abadi Ghadim, (2003) who established a positive relationship between income and adoption of technology. However, farming experience had inverse relationship with the level of adoption implying that more experienced rice farmer is likely be cautious in taking risks of adopting new technologies than less experienced farmer.

Table 6: Correlation between selected personal characteristics and levels of adoption of upland NERICA technologies

Variables	r-value	p-value
Farming Experience	-0.02**	0.00
Farm Income	0.40**	0.00

Source: Field survey, 2016

CONCLUSION

This study established that adoption of NERICA technologies was low, consequence upon the possibility that the rice farmers were at the verge of taking full adoption decision. Level of adoption was influenced by farm income and farming experience. The study concluded that the adoption of NERICA technologies was inadequate in the study area and recommended that government should provide modern communication infrastructure and regular training of extension agents to deliver quality and quantity information based on the rice farmers' need to increase adoption as well as rice production.

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