ajfand
SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 18 No. 3
December 2018
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Afr. J. Food Agric. Nutr. Dev. 2018; 18(3): 13617-13633 DOI: 10.18697/ajfand.83.16265

ADOPTION OF NEW RICE FOR AFRICA (NERICA) TECHNOLOGIES IN EKITI STATE, NIGERIA

Ojo OF[1]*, Dimelu MU[1] and MN Okeke[2]

Ojo Oluwasegun Felix

*Corresponding author email: felix.ojo@unn.edu.com

[1]Department of Agricultural Extension, University of Nigeria, Nsukka. Nigeria

[2]Department of Agricultural Economics and Extension, Chukwuemeka Odumegwu University, Anambra State, Nigeria

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 18 No. 3
December 2018
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

ABSTRACT

Acceptance of new agricultural technology can lead to significant increase in productivity, income and improve livelihood of rural poor farmers in Nigeria. The study assessed adoption behaviour of the beneficiaries of Multinational (New Rice for Africa) NERICA Rice Dissemination Project in Ekiti State, Nigeria. Simple random sampling technique in a multistage sampling procedure was used to select 52 beneficiary rice farmers. Data were collected through the use of structured interview schedule and analysed using mean score, adoption index, multiple regression and factor analysis. The results revealed that majority (80.4%) of rice farmers were males, average age of the farmers was observed to be 40years and average farming experience of the famers was found to be 19years. Also, results showed high adoption score for planting distance, early planting, late planting and harvesting duration (61%), fertilizers use (95%) and herbicides use (75%), while water efficiency methods (26%) and improved rice varieties (48%) of the NERICA disseminated technologies had low adoption. Regression analysis indicated that only age and number of years spent in school influenced adoption decisions of rice farmers. The perceived serious constraints to adoption of improved NERICA rice technologies were menace of birds on rice field (M = 4.96), menace of grass cuter (M = 4.47), high cost of labour (M = 3.41), poor access to road (M = 3.61) amongst others. Also, the perceived not serious constraints to adoption of improved NERICA rice technologies were lack of sufficient land (M =1.96), untimely availability of improved NERICA rice varieties (M = 1.92), inadequate knowledge about rice processing techniques (M = 1.78), inadequate access to NERICA rice varieties (M = 1.59) and incompatibility of innovations conflict between technology and norms of the people (M = 1.59). Therefore, the study recommends that researchers should increase farmers' participation and interaction of local and ecological knowledge to enhance generation of socially, economically and ecologically adaptable rice varieties.

Key words: New Rice for Africa (NERICA), adoption, rice farmer, technologies

DOI: 10.18697/ajfand.83.16265

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 18 No. 3
December 2018
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

INTRODUCTION

Rice (*Oryzasativa*) is an important food crop. It is an ancient crop consumed as a healthy and staple food by more than half of the world's population [1]. Rice production in Nigeria increases gradually over the years, with area expansion surpassing major rice producing countries like Côte d'Ivoire and Sierra Leone [2]. However, demand in recent times has not been accompanied by a corresponding rise in production. This is attributed to wide spread poverty, dominance of the nation's agriculture by smallholders [3] the use of relatively primitive tools for farm operations [4], lack of exposure to improved agricultural technology (improved seeds, fertilizers, and pesticides) and inadequate farm mechanisation aids by government [1].

In order to increase and improve rice production in Africa, New Rice for Africa (NERICA) technologies were disseminated to the rice growers through the implementation of Multinational NERICA Rice Dissemination Project in some countries across sub-Saharan Africa (SSA) including Nigeria in 2005. New Rice for Africa is a group of rice varieties resulting from the inter-specific crossing between the Asian rice (*Oryzasativa*) and the African rice (*Oryzaglaberrima*) [5]. New Rice for Africa symbolises hope for many Nigerian rice farmers for it is well adapted to the harsh growing environment in the country where smallholder farmers struggle in rural and urban communities, spending most of their meagre income on rice production activities [6]. It has advantages over imported rice widely available in Nigerian local markets. Moreover, it has early maturity rate of 50-70days, resistant to local stress (blast, stem borer and termite) and high quality of protein content (25%) [2].

In Nigeria, with the aim to enhance rice production and increase income of smallholder farmers in the country, multinational NERICA Rice Dissemination Project (MNRDP) was implemented in 2005 in six States including Ekiti State where this study was carried out. The participating States were selected due to their potential for increased rice production, interest and enthusiasm demonstrated by the upland rice growers during NERICA participatory variety selection (PVS) programme, available culture of rice growing and farmer groups and community-based institutions which were supportive of rice development programmes [7]. New rice for Africa technologies disseminated in the state include improved rice varieties, agronomic practices, and agrochemicals.

Objectives of the study:

1. Describe the socio-economic characteristics of the NERICA rice farmers,
2. Determine the level of adoption of NERICA improved rice technologies,
3. Determine factors that influence adoption of NERICA rice technologies and ascertain the perceived constraints on the adoption of NERICA.

THEORETICAL FRAMEWORK

The role of technological innovations in raising agricultural productivity and in fostering overall agricultural development is well-known and was documented in 2008 [8]. There is now renewed interest for greater investment in agricultural innovation in Africa, a continent where the vast majority of the population derive its livelihood from agriculture and where farmers are among the poorest in the world despite a largely unexploited

DOI: 10.18697/ajfand.83.16265

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 18 No. 3 December 2018 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

agricultural potential with respect to land and water [9]. Agricultural innovation needs to internalize the biophysical, institutional and socio-economic constraints and establish efficient value chains to support sustainable growth and to reduce poverty. This is a challenging task, given the numerous failed experiences of the past. Agricultural research can catalyze agricultural innovation and value chain development. One such example is the New Rice for Africa (NERICA) rice varieties that were developed by the Africa Rice Centre [9]. This paper looks at the issues about adoption by end users and factors that affect adoption. A study carried out by Adedeji *et al*. [5] observed that age of the farmers, and farm size, farming experience and frequency of ADP contact were the most significant socio-economic variables influencing the level of adoption of NERICA improved rice technologies in Ogun State, Nigeria. There was a considerable uptake of NERICA varieties in Kaduna and Ekiti states. About 30% of farmers in Ekiti cultivated NERICA1 in 2005, and 42% and 19%, respectively in PVS and near-PVS villages in Kaduna. Adoption of NERICA1 appears to have continued during 2004 and 2005 despite a scaling down of PVS activities in these years. In 2005, adoption of NERICA2 was observed in Kaduna with 14% and 9% of farmers growing NERICA 2 in PVS and near-PVS villages respectively [10]. Also, Spencer *et al*. [10] noted that 35% of farmers in Ekiti and Kaduna near-PVS villages had not heard of NERICA1, showing the potential for increase in adoption rates and found that the percentage of households that grow NERICA varieties in Uganda increased from 0.9% in 2002 to 2,9% in 2003 and reached 16,5% in 2004. They found that membership of a farmer's group, formal education of the household head, and the number of household members significantly increased the probability of adopting NERICA varieties. They also showed that rice-growing experience, membership to a farmer's group, and formal education increased the scale of area planted to NERICA varieties. The land size per person had a negative effect on the share of land planted to NERICA varieties, which suggests that land-poor households tend to allocate a larger proportion of land to cultivation of NERICA varieties

The adoption of the high yielding variety has positive effect on household well-being in Bangladesh [11]. Kijima *et al*. [12] observed in this study positive impact of NERICA in Uganda and also found out that NERICA adoption reduces poverty without deteriorating the income distribution. Varietal attributes such as swelling capacity and short growing cycle were important determinants of adoption of NERICA varieties [13].

METHODOLOGY

Study area

The study was conducted in Ekiti State, Nigeria. Ekiti State is one of the major rice producing areas in the South Western Nigeria. Ekiti State is made up of 16 Local Government Areas and with a population of 2,398,957 people made up of 1,215,487 males and 1,183,470 females [14]. The land under rice cultivation in the state was put at 8650 hectares in 2010 [15].

Sampling techniques

The population of the study constituted the beneficiary farmers of NERICA Rice Project in Ekiti State. A multistage sampling technique was employed in selecting respondents. In the first stage, four Local Governments Areas (LGAs) were purposively selected from

DOI: 10.18697/ajfand.83.16265

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 18 No. 3 December 2018 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

the sixteen LGAs in the state based on their involvement in rice production activities and participation in the project. The four rice producing LGAs are: Irepodun and Ifelodun, Ikole, Gbonyin and Emure. In the second stage, three NERICA participating town communities from each of the four LGAs were obtained from state NERICA office, because of their participation in the project, giving a total of twelve town communities. In the third stage, a list of ten rice farmers was collected from NERICA a farmer's group in each selected town community. From the NERICA rice farmers' list provided, five NERICA beneficiary rice farmers were selected each, using simple random sampling technique. This gave a total number of 60 NERICA beneficiary rice farmers for the study. However, after thorough data cleaning only 52, representing 86.7% were finally used for the analysis.

Data were collected from beneficiary rice farmers through the use of structured interview schedule. The interview schedule administered to beneficiary rice farmers contained relevant questions based on the objectives. Content and face validity were carried out to ensure that the instruments effectively collect the data they were meant to collect. Lecturers in the Department of Agricultural Extension, University of Nigeria, Nsukka validated instrument before they were administered to respondents. The instruments were pre-tested in Igbemo, a town community in Irepodun/Ifelodun Local Government Area of Ekiti State. For reliability, test and retest technique was employed. The coefficients of test retest for the instrument was alpha coefficient of 0.863.

The data collected were analysed using descriptive statistics, adoption index, and multiple regression analysis. Descriptive statistics entails the frequency tables, which show the distribution of the socio-economic characteristics of the farmers such as age, sex, household size, farming experience, educational attainment and number of extension visits per year. The adoption index shows the adoption levels of the improved technologies disseminated to the rice farmers. The items that are involved in adoption levels of rice improved technologies include: water efficiency methods, improved rice varieties, planting method, agronomic practices, fertilizer application and herbicide application. The stages or steps that an individual goes through in adopting an innovation are in a flow chart below.

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 18 No. 3
December 2018
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

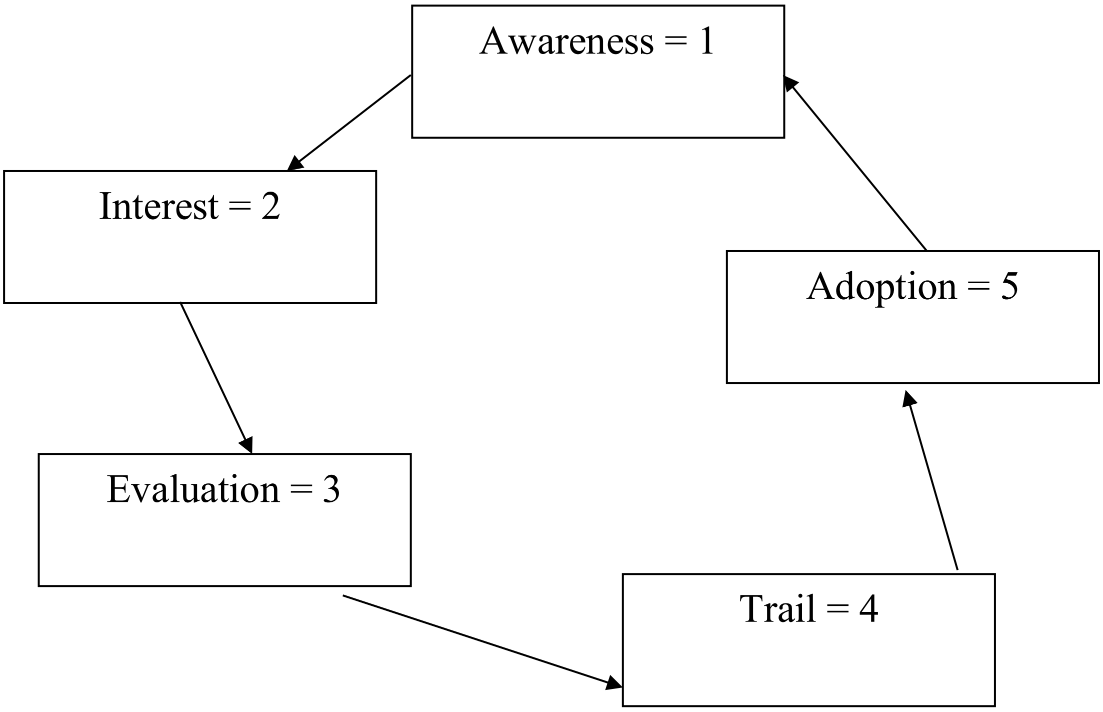

Figure 1: Stages or steps of adoption

The adoption indices of the farmers were calculated as follows:

- Computation of the total mean (M) adoption score. This was computed by dividing the total adoption score by the number of respondents (n =52).
- Computation of the grand mean (M) adoption score. This was calculated by adding all the adoption scores and dividing them by the number of innovations considered.
- Computation of the adoption index, this was carried out by dividing the grand mean (M) adoption score by 5 (that is, the 5-stages of adoption).

To ascertain the perceived constraints to adoption of NERICA rice technologies, a list of possible constraints was presented to respondents to indicate the level of their perceived seriousness on a 3 point Likert-type scale: very serious = (3); serious = (2); not serious = (1). These values were added to obtain a value of 6 which was divided by 3 to get a mean score of 2.0. Variables with mean score less than 2.0 were regarded as not serious while variables with mean score equal to or above 2.0 were regarded as serious constraints.

The regression analysis shows the socio-economic factors that determine the adoption of NERICA technologies. The model of the regression analysis is as follows:

$$\mathbf{Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + U}$$

Where Y = adoption of NERICA improved rice technologies, X_1 = age (years); X_2 = years spent in formal education (years); X_3 = household size (actual number); X_4 = number of extension visits per year; X_5 = size of farm (hectares); X_6 = sex (dummy: male = 1, female = 0); X_7 = farming experience (years); $\boldsymbol{\alpha}$ = constant; $\beta_1 - \beta_7$ = parameters to be estimated.

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 18 No. 3 December 2018 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

RESULTS

The results presented in Table 1 show that majority (80.4%) of the farmers were males, while less than 20% were females. The average age of the farmers was observed to be 40years, as majority of them (39%) falls within age's 40-49years.It was observed that 86% of the farmers were literates, with over 37% completed secondary school education. Majority (49%) of the farmers had farming experience ranging from 11-20years, which puts the average farming experience at 19years.Over 70% of the rice farmers had contact with Agricultural Development Project (ADP) officials more than 10 times in a year.

Table 2 showed adoption levels of rice improved technologies disseminated by Multinational NERICA Rice Dissemination Project in the study area, Table 3 showed factors influencing the adoption of rice improved technologies which include: age of the farmers, number of years spent in school, household size, extension contact, farm size, farm experience and sex. Table 4 showed constraints to adoption of improved NERICA rice technologies, which include menace of birds, menace of grass cuter, inadequate access to NERICA rice varieties, incompatibility of innovations (conflict between technology and norms of the people), and inadequate technical knowledge.

DISCUSSION

The results of socio-economic characteristics of rice farmers

The results presented in Table 1 show that majority (80.4%) of the farmers were males, while less than 20% were females. The high number of male rice farmers is due to land ownership rights that the male farmers have over their female counterparts and the laborious nature of rice production in the area. The average age of the farmers was observed to be 40years, as majority of them (39%) falls within age's 40-49years. This shows that farmers are still in their economically active age (15-64 years) and might still be interested in seeking new innovations that can improve their overall rice production. This finding is in line with the report of Nwalieji and Uzuegbunam [16] who reported that majority of rice farmers are still within their middle, active and produce ages and hence can engage efficiently in rice production. It was observed that 86% of the farmers were literates, while over 37% completed secondary school education. Literacy could positively influence their propensity to adopt new knowledge and practices in rice production. The average household is 7persons. Majority (49%) of the farmers had their farming experience falling within 11-20years, which puts the average farming experience at 19years. This reveals that most of the farmers have been in rice farming for a long time. Over 70% of the rice farmers had contact with ADP officials more than 10 times in a year. This shows that rice farmers had robust access to extension services which enables them to understand technical and agricultural information about NERICA rice technologies. Lahai *et al.* [17] found a direct relationship between farmers' frequency of contact with extension agents and their levels of participation in extension education. It was viewed that, frequent contact of farmers with extension agents helps them to internalize well the extension education they receive as issues can be clarified whenever the contact occurs. Also, farmers' frequency of contact with extension agents has a direct relationship with effectiveness of extension the more the frequency of contact of farmers with extension agents the better the effectiveness of the extension service [18, 19].

DOI: 10.18697/ajfand.83.16265

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 18 No. 3
December 2018
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Adoption Level of NERICA Improved Rice Technologies

Table 2 reveals the adoption levels of improved rice technologies disseminated by Multinational NERICA Rice Dissemination Project to rice farmers in Ekiti State. The NERICA improved rice technologies were water efficient in rice production, improved rice varieties, planting method, agronomic practices, fertilizer and herbicide use.

1. Water efficiency

Entries in Table 2 indicate that water pumps had higher adoption mean score of 1.43, while channelization had adoption mean score of 1.14. Their grand mean was 1.29, with adoption index of 0.26. The adoption mean scores could imply that majority of the NERICA participant farmers are still at awareness level of the adoption process in the water efficiency methods of rice production. The adoption index of 0.26 means that 26% of the farmers have adopted the technology and the adoption process is still below average. The low adoption of these technologies means that provision of water facility (digging of a borehole in a farmer's field) would not have encouraged farmers to accept this technique of making water efficient in their farms.

2. Improved rice varieties

New rice for Africa (NERICA) 1 (onitiro, Yoruba language in Nigeria) had the highest adoption mean score of 3.12. This was followed by NERICA 8 that had adoption mean score of 2.98, and NERICA 7 with mean adoption score of 2.25. FARROW 44 had adoption mean score of 1.94 and FARROW 52 had adoption mean score of 1.63. The grand mean was 2.38, with adoption index of 0.48. This implies that majority of NERICA beneficiary farmers were still at interest level of the adoption process in the use of improved rice varieties disseminated by the MNRDP. The adoption index implies that 48% of the beneficiary farmers had adopted all the technologies disseminated under the improved rice varieties, and it also implies that farmers are still below average in adoption level. The low adoption of the technologies might be due to some serious constraints to adoption of improved NERICA rice technologies in the area, such as menace of birds, menace of grass cuter, poor access road to farmers' farms and high cost of labour et cetera. This finding is in agreement with Adedeji *et al*. [5] who reported that low adoption of NERICA rice varieties was largely due to incidence of pests such as rodents and birds.

3. Planting methods

Broadcasting had a higher adoption mean score of 3.67 and followed by dibbling (20cm by 20cm) with adoption mean score of 2.43. The grand mean was 3.05, with adoption index of 0.61. The grand mean implies that the farmers are still at the evaluation level on the adoption process in the use of planting methods. The adoption index of 0.61 means that 61% of the farmers had adopted the technologies, but at above average level. The findings show that majority of the rice farmers preferred broadcasting as a planting method. The high adoption could be because it is less stressful and time-saving and probably less capital/labour intensive. Direct seeding in form of broadcasting and drilling was the main establishment technique of planting rice in Oyo State, Nigeria [20].

DOI: 10.18697/ajfand.83.16265

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 18 No. 3 December 2018
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

4. Agronomic practices
Table 2 reveals that late planting (May – June) had the highest adoption mean score of 3.53. This was followed by late harvesting (September –October) (M = 3.35) and timely harvesting (July – August) (M = 2.65). On the other hand, early planting (March- April) had adoption mean score of 2.63 and planting spacing (20cm by 20cm) had adoption mean score of 1.63. The grand mean was 2.76, with adoption index of 0.55. The grand mean implies that the farmers are still on evaluation level of the adoption process in the use of agronomic practices disseminated to the project farmers. The adoption index of 0.55 means that 55% of the beneficiary farmers have adopted the technologies at above average. These findings could be due to the necessity or importance of agronomic practices in rice production.

5. Fertilizer use
The Nitrogen, phosphorus and potassium NPK 15: 15: 15 had the highest adoption mean score of 4.92. This was followed by urea with adoption mean score of 4.76 and broadcasting (method of fertilizer application) at adoption mean score of 4.53. The grand mean was 4.73, with adoption index of 0.95. The grand mean implies that the beneficiary farmers have adopted the fertilizer package disseminated by the NERICA project. The adoption index of 0.95 could imply that nearly all (95.0%) the NERICA beneficiary rice farmers had adopted each of the three innovations under fertilizer use and are at adoption stage of the adoption process. This could be attributed to the importance of fertilizer application which rural farmers still depend on in order to improve their productivity. This is in agreement with Adeola *et al*. [20] who asserted that all rice farmers apply chemical fertilizers to their rice farms; however, there are differences in the quantity of the fertilizers applied owing to differences in their abilities to purchase the input.

6. Herbicide use
Oryzo Plus had the highest adoption mean score of 4.86. This was followed by Touchdown with adoption mean score of 3.75 and lastly, Solito had an adoption mean score of 2.43. The grand mean was 3.68, with adoption index of 0.74. The grand mean implies that farmers are still at the trial level of the adoption process in the use of herbicide disseminated by NERICA project. The adoption index of 0.74 means that 74% of the farmers had adopted the technologies under herbicide application, the adoption level of the farmers was above average. The high adoption of herbicide application explains the importance of herbicide farmer needed to put in place against weed, insect/disease and pest in their farms. The use of herbicide has been observed as major labour-saving device as the labour requirement for weeding always accounts for a high proportion of the total farm labour cost in rice production [21]. Weeds reduce farm and forest productivity, they invade crops, smother pastures and in some cases can harm livestock. They aggressively compete for water, nutrients and sunlight, resulting in reduced crop yield and poor crop quality [22].

Factors influencing the adoption of rice improved technologies
Table 3 shows that from regression results, there was no significant relationship ($F = 1.433$; $p \leq 0.05$) between the socio-economic characteristics of the rice farmers and adoption of disseminated NERICA rice technologies. The variables were age (years),

DOI: 10.18697/ajfand.83.16265

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 18 No. 3 December 2018 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

number of years spent in school, household size, extension contact, farm size, farming experience and sex.

The R Square value (0.189) indicates the proportion of variability in the adoption of the improved rice technologies which were accounted for by the multiple regression equation. The adjusted R Square (0.057) is an estimate of r^2 for the population. Nearly 6% (adjusted R Square) of the variance in adoption of improved rice technologies is explained by age and number of years spent in school.

The B value is the regression coefficients for the variables (example age (0.01)), but these values do not show the level of importance of each predictor variable. The level of importance is shown when the B value have been transformed into standard scores (beta B values). Therefore, the standardized coefficients Beta reveal age of the farmers (0.46) had much influence on adoption of improved rice technologies than household size (0.12) and farming experience (-0.37).

Table 3 shows that age of rice farmers had a positive influence on adoption of improved rice technologies. This agrees with findings of Adedeji *et al.* [5], Mamudu *et al.* [23], and Saka *et al.* [24] that age of the farmers was part of the most significant socio-economic variables influencing the level of adoption of improved rice technologies. Age of farmers can determine their decision to adopt new technologies. The farmers are in their economically active stage of life. This assists and influences decision and attitude to adoption of technology.

Also, there was a positive significant relationship between number of years spent in school and adoption of improved rice technologies in the area. This confirms the work of Saka *et al.* [24] who reported that number of years spent in school could influence positively adoption of improved rice varieties. Formal education can increase and enhances farmers' ability to understand and make use of new farming techniques.

There was no significant relationship between farm size and adoption of improved rice technologies. This is contrary to the findings of Saka *et al.* [24] in which size of rice farms significantly influenced the adoption of improved rice varieties.

Perceived constraints to adoption of improved NERICA rice technologies

Table 4 shows that the perceived serious constraints to adoption of improved NERICA rice technologies were: menace of birds destroying the rice field (M = 4.96), menace of grass cuter as pest (M = 4.47), high cost of labour (M = 3.41), high cost of agrochemicals (M = 3.10), inadequate credit facilities (M = 2.14), poor market for the harvested rice (M = 2.73), poor access road to farmers' farms (M = 3.61) and poor access to water (M = 2.51). However, inadequate access to NERICA rice varieties (M = 1.59), incompatibility of innovations (M = 1.59), lack of sufficient land (M = 1.96), lack of adequate technical knowledge on the use of improved technology (M = 1.45), inadequate/poor extension contact (M = 1.12), poor fertility of the soil (M = 1.61) and others were regarded as not serious constraints. This shows that eight (8) out of the nineteen (19) variables (which represents 42% of the variables) were perceived by the beneficiary famers as serious constraints militating against adoption of improved NERICA rice technologies. A good

DOI: 10.18697/ajfand.83.16265

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 18 No. 3
December 2018
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

number of standard deviation values were more than one whole number, showing that responses of the farmers on these constraints varied and it signifies divergence of views with regard to these constraints.

Personal information obtained during the data collection revealed that beneficiary farmers complained bitterly about the damage done to rice farms by birds, which had caused a lot of participating farmers to discontinue with improved NERICA rice varieties. Largely this could explain the findings by Adedeji *et al*. [5] that non-adopters had higher output and yield than the adopters of NERICA technologies. It was observed that pests have preference for NERICA paddy output over the local rice varieties. Furthermore, according to Odogola [25], pests are among the most serious constrains of both lowland and upland rice and if not effectively controlled, can cause considerable loss in crop yield and markets.

Although rice farmers had access to inputs like agrochemicals, extension services and training on how to combat pest like grass cuter to some extent, these measures still seem inadequate in the process of effective adoption of improved NERICA rice technologies. These findings are similar to those of Lahai *et al*. [17] who suggested that high cost of production, low income to farmers, low savings/investment are responsible for the widespread incidence of poverty among rice farmers and hence, the persistence of constraints in rice production.

CONCLUSION

The study shows that younger farmers dominated rice production with about two-thirds of them with 30 years and above. This is a good signal because they are still in their economically active age and might still be interested in seeking new innovations that can improve their overall rice production. The findings revealed the number of years spent in school and age were key determinant to adoption of NERICA improved rice technologies. The findings revealed that menace of birds, menace of grass cuter, high cost of labour, high cost of agrochemicals, inadequate credit facilities, poor market for the harvested rice, poor access road to farmers' farms and poor access to water were perceived to be serious constraints to adoption of improved NERICA rice technologies. Generally, there appeared to be a relatively low level of adoption of NERICA rice technologies except for fertilizers, herbicides, agronomic practices and planting methods which accompany complementary technologies. It is good to note that complementary technologies could not have been totally strange to the rice farmers while NERICA rice technologies could have been incompatible with existing knowledge, preference and culture of the rice farmers.

DOI: 10.18697/ajfand.83.16265

RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made:

- Researchers should enhance farmers' participation and interaction of local and ecological knowledge to enhance generation of socially, economically and ecologically adaptable rice varieties.
- Government should evolve strategies that will encourage involvement of more educated and young people in rice production.
- Government interventions/agricultural development programme should be accompanied by released infrastructures, production inputs for quick uptake by beneficiaries.
- Formation and use of farmers' groups should be maintained by extension service to assist farmers explore the advantage of economies of scale.
- Compatibility of NERICA rice technologies should be looked into in terms of preference, knowledge and culture of the rice growers.

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 18 No. 3 December 2018 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Table 1: Socio-economic characteristics of the selected rice farmers

Socio-economic characteristics	Frequency	Percentage	Mean
Age(years)			
20-29	7	13.9	
30-39	11	21.7	
40-49	20	39.2	40
50-59	9	17.6	
60 & above	4	7.9	
Sex			
Male	41	80.4	
Female	10	19.6	
Educational level			
No formal education	8	10.3	
Primary school attempted	1	13.8	
Primary school completed	5	19.0	
Secondary school attempted	12	6.9	
Secondary school completed	13	37.9	
Ordinary National Diploma/National Certificate in Education	10	6.9	
Higher National Degree/First degree	2	5.2	
Household size			
1-5persons	15	29.5	
6-10persons	29	56.8	7
11-15persons	7	13.7	
Farming experience			
Less than 10years	11	28	
11-20years	26	49	
21-30years	11	22	19
31-40years	4	8	
Frequency of extension visit			
1-5times	17	33	
6-10times	23	45	8
11-15times	8	16	
16-20times	3	6	

Source: Field survey, 2013

DOI: 10.18697/ajfand.83.16265

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 18 No. 3 December 2018
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Table 2: Adoption levels of rice improved technologies disseminated by Multinational NERICA Rice Dissemination Project in Ekiti state, Nigeria

	Rice Improved Technologies	Adoption Mean score	Grand Mean	Adoption Index
A	**WATER EFFICIENCY IN RICE PRODUCTION**			
I	Channelization	1.14	1.29	**0.26**
Ii	Water pumps	1.43		
B	**IMPROVED RICE VARIETIES**			
I	NERICA 1	3.12		
Ii	NERICA 7	2.25		
Iii	NERICA 8	2.98	2.38	**0.48**
Iv	FARROW 44	1.94		
V	FARROW 52	1.63		
C	**PLANTING METHOD**			
I	Dibbling (20cm by 20cm)	2.43	3.05	**0.61**
Ii	Broadcasting	3.67		
D	**AGRONOMIC PRACTICES, SYSTEMS AND TECHNOLOGIES**			
I	Planting spacing (20cm by 20cm)	1.63		
Ii	Early planting (March-April)	2.63		
Iii	Late planting (May –June)	3.53	2.76	**0.55**
Iv	Timely harvesting (July – August)	2.65		
V	Late harvesting (September – October)	3.35		
E	**FERTILIZER**			
I	NPK (15: 15 :15)	4.92		
Ii	Urea	4.76	4.73	**0.95**
Iii	Broadcasting (method of fertilizer application)	4.53		
F	**HERBICIDE**			
I	Solito	2.43		
Ii	Touchdown	3.75	3.68	**0.74**
Iii	Oryzo plus	4.86		

Source: Field survey, 2013.

DOI: 10.18697/ajfand.83.16265

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 18 No. 3
December 2018
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Table 3: Factors influencing adoption of rice improved technologies

Variables	Unstandardized Coefficients		Standard Coefficients		
	B	Standard Error	Beta	T	Sig.
(Constant)	2.50	0.33		7.10	0.00
Age	0.01	0.01	0.46	1.96	0.05*
Number of year spent in school	0.02	0.01	0.32	2.04	0.04*
Household size	0.01	0.02	0.12	0.76	0.44
Extension contact	0.00	0.01	-0.01	-0.08	0.96
Farm size	-0.01	0.01	-0.12	-0.81	0.43
Farming experience	-0.01	0.02	-0.37	-1.64	0.11
Sex	-0.02	0.12	-0.03	-0.22	0.83

Dependent variable: adoption scores R Square = 0.189; R^2 = 0.057; F-value = 1.433; $p \leq 0.05$ Note. T = t-value, sig = significant, * = significant at 95% level of significance

Table 4: Mean distribution of beneficiary farmers perceived constraints on adoption of improved NERICA rice technologies

Variables	Mean	SD
Menace of birds destroying the rice field	4.96*	0.196
Menace of grass cuter as pest	4.47*	0.504
Inadequate access to NERICA rice varieties	1.59	0.876
Incompatibility of innovations (conflict between technology and norms of the people)	1.59	0.983
High cost of labour	3.41*	1.268
High cost of agrochemicals	3.10*	1.487
Lack of sufficient land	1.96	1.399
Lack of adequate technical knowledge on use of improved technology.	1.45	0.730
Inadequate/poor extension contact	1.12	0.588
Poor fertility of the soil	1.61	1.150
Inadequate knowledge about rice processing techniques	1.78	1.189
Inadequate credit facilities	2.14*	1.371
Low yield	1.31	0.735
Poor resistance of varieties to disease infestation	1.65	1.036
poor market for the harvested rice	2.73*	1.524
Inadequate information on NERICA project	1.20	0.601
Untimely availability of improved NERICA rice varieties	1.92	1.324
Poor access road to farmers' farm	3.61*	1.563
Poor access to water	2.51*	1.654
Incompetence of the extension staff	1.31	0.735

*Serious constraint. Source: Field survey, 2013

DOI: 10.18697/ajfand.83.16265

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 18 No. 3
December 2018
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

REFERENCES

1. **Daramola B** Rice policy and food security in sub-Saharan Africa. Paper presented at the workshop organized by WARDA, Cotonou, Republic of Benin, 2005.

2. **West Africa Rice Development Centre.** Progress report for 2003-2005. 2006.

3. **Daramola AG** Competitiveness of Nigerian agriculture in a global economy: Any dividends of democracy? Inaugural lecture series 36, Federal University of Technology, Akure. Ondo State. 2004, 36.

4. **Fakorede MAB** Revolutionizing Nigerian agriculture with the golden seed. Inaugural lecture, Obafemi Awolowo University, Ile Ife, Osun State 2001.

5. **Adedeji TO, Nosiru MO, Akinsulu AA, Ewebiyi IO, Abiona BG and TS Jimoh** Adoption of new rice for Africa (NERICA) technology in Ogun State, Nigeria. *J. of Development and Agric. Eco.* 2013;**5** (**9**):365-371.

6. **Caulibaly M, Akator K and T Ata** Existence of two pathotypes of rice yellow virus, Genus sabemovirus in Mali. *Plant pathology J.*2006;**5**(**3**): 368-372.

7. **African Development Fund.** Multinational NERICA rice dissemination project. Project appraisal report. Agriculture and rural development department, central and west region. Afdb –Tunisia. 2003.

8. **World Bank.** World development report 2008: Agriculture for development. Washington DC: World Bank 2008.

9. **Diagne A, Midingoyi SG, Wopereis M and I Akintayo** The NERICA success story: Development, achievements and lessons learned. Draft paper for the Africa Rice Centre (AfricaRice). Cotonou, Benin. April 2010.

10. **Spencer D, Dorward A, Abalu G, Philip D and D Ogungbile** Evaluation of adoption of NERICA and other improved upland rice varietal promotion activities in Nigeria: A study for the Gatsby and Rockefeller foundations. Final report, January 2006.

11. **Mendola M** Agricultural technology adoption and poverty reduction: A propensity-score matching analysis for rural Bangladesh. *Food Policy,* 2006; **32:**372-393.

12. **Kijima Y, Sserunkuuma D and K Otsuka** How revolutionary is the ‘’NERICA revolution’’? Evidence from Uganda. *The Developing Economies,* XLIV-2 (June 2006):252-67.

13. **Adegbola P, Arouna A, Diagne A and SA Adekanmbi** Determinants socio-economic et tauxd’adoption et d’ adoption des nouvelles varieties de riz NERICA au Centre du Benin. Papier a soumettre pour publication. 2005.

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 18 No. 3
December 2018
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

14. **National Population Commission.** Population figure. Federal republic of Nigeria, Abuja. 2007. (http://www.npc.gov) accessed12th August, 2012.

15. **Ekiti State Agricultural Development Programme.** Multinational NERICA Rice Dissemination project. Project progress report presented to the AfDB supervisory mission's meeting held in Lafia, Nassarawa State, Nigeria on 17th - 19th, 2010.

16. **Nwalieji HU and CO Uzuegbunam** Effect of climate change on rice production in Anambra State, Nigeria. *J. of Agric. Exten,* December 2012;**16**(**2**): 81-91.

17. **Lahai BAN, Goldey P and GE Jones** The gender of the extension agent and farmers' access to and participation in agricultural in Nigeria. *J Agric Educ. Exten.* 2000;**6**(**4**):223-233.

18. **Aphunu A and CSO Otoikhian** Farmers' perception of the effectiveness of extension agents of Delta State Agricultural Development Programme (DADP). *Afr. J General Agric.* 2008, **4**(**3**): 165-169.

19. **Sarker MA and Y Itohara** Farmers' perception about the extension services and extension workers: The case of organic agriculture extension programme by PROSHIKA. *Am. J. Agric. Biol. Sci* 2009 ;**4** (**4**):332-337.

20. **Adeola RG, Adebayo OO and GO Oyelere** Effects of the federal government special rice programme on rice yields and farmers' income in Oyo State. International *J. of Agric. Eco& Rural Development* (IJAERD). 2008;(**1**): 1-6.

21. **Ogundele OO and VO Okoruwa** Technical efficiency differential in rice production technologies in Nigeria. 2006.

22. **Department of Environment.** Impact of weeds on agriculture. A publication of the department of environment of Australian government. 2014.

23. **Mamudu AA, Emelia G and KD Samuel** Adoption of modern agricultural production technologies by farm households in Ghana: What factors influence their decisions? *J. of Biology, Agric. and Healthcare.* 2012;**2**(**3**):1-14.

24. **Saka JO, Okoruwa VO, Lawal BO and S Ajibola** Adoption of improved rice varieties among smallholder's farmers in South-Western, Nigeria. *World J. of Agric Sci* 2005;**1** (**1**): 42-49.

25. **Odogola R** Final survey report on rice production, processing and marketing in Uganda. 2006.

26. **Manyong VM, Ikpi A, Olayemi JK, Yusuf SA, Omonana R and FS Idachaba** Agriculture in Nigeria: Identifying opportunities for increased commercialization and investment. A research work funded by USAID/Nigeria, 2003.