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Adoption Differentials and Benefits of Improved Rice Production Technologies among Farmers in Ebonyi State of Nigeria

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Abstract
This study was undertaken to investigate adoption differentials and benefits of improved rice production technologies among farmers in Ebonyi State of Nigeria. Multi-stage random and systematic sampling techniques were used to select a total of 240 (two hundred and forty) rice farmers from the three agricultural zones of the State. Primary data were sourced directly from the rice farmers and analyzed using both descriptive and inferential statistics. The result of data analysis indicates that most of the rice farmers adopted soil improving technologies such as use of agrochemicals (X = 3.3), zero tillage (X = 3.2), fertilizer application (X = 3.1) whereas, improved processing (X = 2.1) and use of modern rice milling (X = 2.0 were the least adopted. Further analysis reveals that most of the farmers sourced information on improved rice production technologies from extension agents (80%), fellow farmers/ neighbours (75.83%), and ADP contact farmers (66.67%). Agricultural shows (18.33%) and meetings (17.5%) were the least sources of information. The result of multiple regression analysis revealed an R^2 of 0.678 and adjusted R^2 of 0.591. All the independent variables were positively signed and statistically significant; indicating that they greatly influenced the dependent variables. The null hypotheses indicate significant differences between yield, income, level of living of the rice farmers before and after adoption. It was concluded that low production of rice in the study area was due to low technology adoption. Recommendations such as formation of rice farmers into cooperative societies and complementing recommended technology package with sources of inputs were made, among others.
Keywords: Adoption, Rice Farmers, Improved Rice Technologies, Ebonyi State, Nigeria

INTRODUCTION

Rice (*Orysa sativa*) is an increasingly important staple crop in Nigeria. It has witnessed some remarkable developments particularly in the past ten years. It is relatively easy to produce and is grown for sale and for home consumption. In some areas of the country, there is a long tradition of rice growing, processing and consumption but for many, rice has been considered a luxury food for special occasions only. With increased availability of rice, it has become part of everyday diet of many in Nigeria. Both rice production and consumption (demand) is growing faster than for any other major staples because consumption is broadening across all socio-economic classes. The substitution of rice for coarse grains, traditional roots and tubers has fuelled growth in demand at an annual rate of 5% per annum, induced by income growth. This is because rice is no longer an occasional food eaten during festive periods but has become an everyday food consumed by most of the inhabitants of Nigeria (Moses and Adebayo, 2007).

Nigeria has a potential land area for rice production of about 4.6 billion hectares. However, only 1.7 million hectares is grown with rice (Imolehin and Wada 2000). The cultivable land of rice spread under five ecologies such as upland, inland or shallow, irrigated, deep water or floating rice and tidal mangrove or swampy rice. The latter is not fully developed due to lack of appropriate technologies (Daramola, 2005). The limited capacity of the Nigerian rice sector to meet the domestic demand has been attributed to several factors; notable among them is the declining productivity due to low adoption of improved production practices. The 360, 000 tonnes of rice produced in the 1960's were enough to meet local demand, but the 1.45 million tonnes produced in the 1990's were not enough (IRRI, 2001, 2005). This created a serious drain on Nigeria's foreign exchange reserve, which stood at US$407.5 million in the 1960's but dropped to US$58 million in the 1990's (IRRI, 2001). The drain on Nigerian's foreign reserve led the Nigerian government to the recent ban on rice importation; because Nigeria is expected to import 15000 tonnes of rice from India in 2009. To reduce the dependence in imported rice as well as to develop the local rice industries government banned milled rice import and put 50% duty on import of parboiled rice. In addition, a levy of 10% was imposed on industries involved in rice importation, including processing and marketing (FAO, 2006).

Availability of a sustainable agricultural technology for Nigerian resource-poor rice farmers is important due to the country's effort at achieving food security. Generation of agricultural research technologies are meaningful only when they are adopted at the farm level. Robert, Arnold and Lori (1989) maintained that farmers are sometimes poor because they have not been able to innovate fast enough to keep pace with changing

circumstances and the accumulation of new knowledge. The adoption of improved technologies was found to be dependent on the interaction of a number of factors. According to Adams (1982), the organized delivery of inputs and outputs, provision of technical advice, stable prices and credit for participating farmers are all important determinants of farmers' adoption of innovation. Adebo and Ewuola (2006) maintained that effective training can promote the adoption of improved farm practices by farmers. In the view point of Onyenwaku (1991), profitability and advice from extension agents were the major reasons for adoption while the characteristics of the innovation itself are the major factors that affects the adoption of any innovation (Justina, 2010). Furthermore, for an innovation or technology to be adopted, Rogers (1962), and Van Den Ben and Hawkin (1991) observed that it must pass through a processes of adoption which involves awareness, interest, evaluations, trial and adoption. According to Paul, Hans Van, Arjan and Katarzyma (2003), the extent to which farmers adopt available innovation and the speed by which they do so determines the impact of innovations in terms of income, yield, increase in living standard and overall productivity growth.

The Nigerian agricultural sector is however dominated by small holder rice farmers who by virtue of their low income have dwindling capacity to access and procure capital, labour and modern inputs. Against the market environments that do not guarantee a fair price for a commensurate returns to investment on modern inputs, the farmers are indeed faced with a production environment that is capable of limiting their enthusiasm to adoption of improved production technologies in rice production. Consequently, this limits the benefits of increased productivity and efficiency derivable from the use of these technologies. Bukar Adam and Bakshi (2007) maintained that in Nigeria, the projected food production will never meet up till 2015 if urgent steps are not taken to address the situation. This has caused a wide gap to exist between potential and actual rice production per hectare. With the steady expansion of the land area under rice cultivation, there ought to be a concurrent increase in rice production in Ebonyi State. However, the production increase has not been enough to meet the consumption demand of the rapidly growing urban population in the State.

Unfortunately, rice farmers in Ebonyi State have not been able to achieve desirable increase in yield possibly due to their low adoption index of improved rice production technologies. Similarly, the activities of the agricultural development project (ADP) as well as other agencies operating in Ebonyi State such as USAID MARKETS towards improving the productivity of smallholder rice farmers do not seem to have created the much expected impact hence the persistent low productivity. The ADP strategy that was initiated by the World Bank in 1975 as an enclave project became established in Ebonyi State in 1996 as a result of national policy on State-wide ADP for enhanced food production. There are some benefit/impact that the project is expected to have conferred on the rice farmers in terms of knowledge of improved cultural practices, agricultural technologies sources and easy access to all necessary inputs for effective productivity and increase in income and standard of living of the rice farmers. This study therefore aims at analyzing the adoption differentials and benefits of improved rice production technologies in Ebonyi State.

OBJECTIVES OF THE STUDY

The broad objective of this study is to investigate the adoption differentials and benefits of improved rice production technologies in Ebonyi State of Nigeria. The specific objectives include to:

iv) determine the level of adoption of improved rice production technologies disseminated by ADPs and other agencies in Ebonyi State;
v) ascertain the sources of information on improved rice production technologies to rice farmers in Ebonyi State; and
vi) examine the effects of adoption of improved rice production technologies on yield, income, and standard of living of the rice farmers.

HYPOTHESES

The following null hypotheses were tested.

$H0_1$: There is no significant difference between the adoption of improved rice production technologies and yield of rice farmers in Ebonyi State.

$H0_2$: There is no significant difference between the adoption of improved rice production technologies and income of rice farmers in Ebonyi State.

$H0_3$: There is no significant difference between the adoption of improved rice production technologies and standard of living of rice farmers in Ebonyi State.

METHODOLOGY

The study was carried out in Ebonyi State of Nigeria, which lies approximately on Latitude $7^0$3N and Longitudes $5^0$4 E in the Eastern part of Nigeria. A multi-stage sampling technique was used to draw samples for the study. Firstly, 2 (two) Local Government Areas were randomly selected from each of the 3 (three) agricultural zones of the State. Secondly, random selection of 4 (four) autonomous communities from each local government area was

made. Thirdly, 10 (ten) rice farmers were systematically selected from each autonomous community. This gave a total of 80 (eighty) rice farmers in each agricultural zone and 240 (two hundred and fourty) rice farmers as the total sample size. A well-structured questionnaire and interview schedule were used to collect primary data for the study. Both descriptive and inferential statistics were employed in data analysis. Objective one was analyzed using means scores derived from a 4-point likert scale. Objective two was analyzed using percentage distribution tables while; ordinary least square multiple regression analysis was used in the analysis of objective three. Nulll hypotheses stated were tested with the aid of Z-test at 5% level of significance.

MEASUREMENT OF VARIABLES

Dependent variable: Adoption is regarded as the decision of a farmer to make use of an innovation or technology as the best course of action available on continuous bases. In this study, the selected improved rice technologies were used to ascertain the level of adoption of the rice farmers. This was measured as the number of recommended improved rice production technologies accepted and used by the rice farmers. Adoption scores were calculated by summing up the number of technologies adopted by the rice farmers.

Yield: this was measured as the total quantity of rice in kg harvested

Income: income was measured as the total amount of money realized from the sales of rice per annum.

Level of living: This is generally used to describe the quantity of goods and services actually consumed by an individual and his family Ekong (2003). This includes the owners hip and use of such items as radio, television, refrigerator, eating of balance regular meals, being well clothed, living in a decent house and surrounding, owing some means of transportation and so on. This was measured by ownership and the use of material things such as kerosene stove, Goss cooker, refrigerator, aluminum pots, grinding machine, sewing machine, motor cycle, bicycle eating of balance regular meals, and being well clothed. These items were converted to monetary values in this study

RESULTS AND DISCUSSION

Level of Adoption of Improved Rice Production Technologies in Ebonyi State.

Availability of suitable arable land production technologies and their subsequent adoption are pre-requisites for rapid agricultural development. The level of adoption of improved rice production technologies by rice farmers in Ebonyi State is shown in Table 1.

Table 1: Percentage Distribution of the Level of Awareness of Improved Rice Production Technologies by Rice Farmers in the Study Area.

Improved Technologies	Means score (X)	Decision
i. Use of improved varieties	3.4	Accepted
ii. Use of agrochemicals	3.3	Accepted
iii. Zero tillage	3.2	Accepted
iv. Fertilizer application	3.1	Accepted
v. Proper spacing	2.9	Accepted
vi. Improved nursery	2.8	Accepted
vii. Timely transplanting	2.7	Accepted
viii. Line planting	2.4	Rejected
ix. Urea deep placement	2.3	Rejected
x. Planting depth	2.3	Rejected
xi. Seed rate	2.3	Rejected
xii. Fertilizer inculcation	2.2	Rejected
xiii. Improved processing	2.1	Rejected
xiv. Use of modern rice milling	2.0	Rejected

Source: Date Analysis, 2013

The result shows that out of the 14 improved rice production technology package provided by the ADP, only 7 were successfully adopted by the farmers. Improved rice varieties had the highest adoption index of (3.4), closely followed by the use of agrochemicals (3.3).Other adopted technologies in the same order include: zero tillage (3.2), fertilizer application (3.1), proper spacing (2.9), improved nursery (2.8) and timely transplanting (2.7).These results agree with the findings of Daramola (1990) who opined that the relatively slow growth of agricultural productivity in Nigeria has been attributed to the fact that majority of the farmers have benefited only marginally from recent advances in food production technology.

Sources of Information on Improved Rice Production Technologies in Ebonyi State.

The problems of agricultural development in Nigeria is no longer lack of research results, but utilization of research output by end-users (rural farmers) as instrument of increased food production, economic growth and social progress. Sources of information on improved rice production technologies to rice farmers in Ebonyi State

was analyzed and shown in Table 2.

Table 2: Percentage Distribution of Sources of Information on Improved Rice Production Technologies in Ebonyi State.

	Sources of Information	Frequency	Percentage
I	Extension Agents	192	80.00
Ii	Fellow farmers/Neighbours	182	75.83
Iii	ADP contact farmers	160	66.67
iv	Religious groups	140	58.33
V	Radio	101	42.08
Vi	Village criers	93	38.75
Vii	L.G.A Agric officers	87	36.25
Viii	Television	72	30.00
Ix	Town criers	93	38.75
x	USAID MARKETS	72	30.00
xi	Agricultural show	44	18.33
xii	Meetings	42	17.50
xiii	Leaflets/newsletters	28	11.67

Source: Field Survey, 2013.

***Multiple responses**

The results of this study inferred that personal information sources such as extension agents/workers, contact farmers and friends and relatives constituted the most important sources of information to the rice farmers. The ADP extension agents remains the major source of information on improved rice production technologies to the farmers (80%). Fellow farmers/neighbours ranked next (75.8%) to extension agents as major source of information on the innovation.ADP contact farmers constituted another major source of information (16.7%) to farmers. However, Agricultural shows (18.3%), meetings (17.50) and leaflets/news letters were the information sources least exploited by the farmers for information on improved rice production technologies.

Table 3: Summary of Multiple Regression Result

Variables	Variable name	Regression coefficient	Standard error	T – Value	Level of significance
B_0	Constant	0.131	0.108	7.677	*
X_1	Yield change	0.207	0.106	1.127	**
X_2	Income change	0.029	0.308	1.799	*
X_3	Change in living standard	1.085	0.405	0.901	*

Source: Data Analysis, 2013

*Significant at 1% level

** Significant at 5% level

$R^2 = 0.678$ Adj $R^2 = 0.591$ F-ratio = 12.451

Standard Error of Estimates = 0.231

Durbin-Watson Constant = 1.234

The result of multiple regression analysis indicates a co-efficient of multiple determination R^2 of 0.678 or 67.8%. This implies that about 67.8% of the variation in adoption of improved rice production technologies resulted in change in yield, income and standard of living of the respondents. The overall effect of the independent variables on the dependent variable was shown by F-statistics which is significant at 1% level of probability. The coefficient of yield change was positively signed and statistically significant at 5% level while income and standard of living bore positive coefficients and were statistically significant at 1% level. This implies that adoption of improved rice production technologies led to substantial change in yield, income and standard of living of the respondents. This agrees with the findings of (Ojo, 2009) who posited that adoption of recommended cassava production technologies had significant influence on income of the farmers in Kogi State, Nigeria. The final regression equation is shown as:

$$Y= 0.131+0.207X_1+0.029X_2+1.085X_3$$

(0.108) (0.106)** (0.308)* (0.405)*

Test of Hypotheses

Table 4: Z-test result showing rice yield before and after adoption of IRPTs

Variable	N	Mean	S.D	Z-cal	Z-crit	Level of probability
After	240	42.19	6.85			
Before	240	15.45	5.88	45.88	1.96	5%

Source: Data Analysis, 2013.

The result of test of difference between yield of rice farmers before and after adoption of IRPTs in the study area shows that Z-cal was 45.88 while Z-tabulated was 1.96. Since Z-cal was greater than Z-tab at 5 percent level of significance, the null hypothesis was rejected while its alternative was accepted. This implies that significant difference exist between yield of rice farmers before and after adoption of IRPTs in the study area.

Table 5 : Z-test result showing income before and after adoption of IRPTs.

Variable	N	Mean	S.D	Z-cal	Z-crit	Level of probability
After	240	26.44	20.49			
Before	240	8.49	5.25	13.15	1.96	5%

Source: Data Analysis, 2013.

The result in Table 5 shows that the calculated Z-value was 13.15, while the table value of Z- statistics at 5% level of significance was 1.96. Since the calculated Z-value of 13.15 is greater than the table value of 1.96; this implies the rejection of null hypothesis and acceptance of its alternative .Therefore, there was a positive relationship between adoption of improved rice production technologies and income of the respondents.

Table 6: Z-test result showing standard of living before and after adoption of IRPTs.

Variable	N	Mean	S.D	Z-cal	Z-Crit.	Level of probability
After	240	8.20	4.44			
Before	240	2.27	0.300	20.65	1.96	5%

Source: Data Analysis, 2013.

The result in Table 6 reveals that, the calculated Z-value was 20.65; while the table value was 1.96 at 5 percent level of significance. Since the calculated value is greater than the table value, the null hypothesis was rejected while its alternative was accepted. This shows that there is a significant difference between the standard of living of rice farmers studied before and after adoption of Improved Rice Production Technologies. This implies that the productivity of farmers increased with adoption of improved technologies and thus improved their standard of living.

CONCLUSION

It can be concluded that the current low rice production level in Ebonyi State of Nigeria is largely attributable to the farmers' reliance on outdated production technologies. The study has proved that the adoption of improved rice production technologies have potentials to launch the State into a major rice producing area in the Continent. However, the level of adoption of these technologies in the area is still at threshold level.

RECOMMENDATIONS

Concerted effort should be made on linking farmers to formal and reliable sources of agricultural information. There is also the urgent need to organize the farmers into cooperative societies for ease of input procurement and financial assistance amongst the farmers and a shift from total reliance on government for production incentives.

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