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Comparative Economic Analysis of Rice Production by Adopters and Non-Adopters of Improved Varieties among Farmer in Paikoro Local Government Area of Niger State

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ABSTRACT: This study was on the Comparative Economic Analysis of Adopters and Non-adopters of improved rice varieties among farmers in Paikoro Local Area of Niger State. Primary data were collected using a structured questionnaire administered to 90 respondents, which consist of 45 adopters of improved rice variety and 45 non-adopters of improved rice variety using stratified random sampling technique. Descriptive statistics, gross margin and production function were used in analyzing the data. The results revealed that 68.9% of adopters were male, while for the non- adopters, 53.3% were male. Costs and returns analysis shows that adopters had the highest mean gross margin of ₦ 58, 663.4 per hectare compared to ₦29, 682.6 per hectare for non-adopters. Semi-log functional form was chosen as the lead equation for adopters and non-adopters with R^2 of 0.92 and 0.65 respectively. Farm Size and fertilizer were significant at 1% and improved seed was significant at 5% level for the adopters, while only farm size and quantity of agro-chemicals were significant at 1% and 10% respectively for the non-adopters. Some of the problems encountered by both categories of farmers in the study area include; pests and diseases, high cost of seed, fertilizer and labour. It is recommended that policy should be designed to ensure adequate supply of inputs to farmers at subsidized rates and extension packages should also be extended to non-adopters.

INTRODUCTION

Recent food production research in Africa has focused more on the use of land, labour, indigenous technology and appropriate mechanism for provision of farm level incentives to farmers (IFPRI, 1986). According to Okereke (1983), technology is the systematic application of scientific knowledge for practical purposes. It includes inventions, innovations, techniques, practices and materials. The components of improved crop production technology in Nigeria include, high yielding varieties, pesticides, improved cultural practices, timely planting and minimum tillage.

In view of this, successful transfer and adoption of new technologies in the traditional farming system depend largely on prior identification of the attributes of the system one is attempting to change (Chatherton and Chattherton, 1985). These technologies should be acceptable to and adoptable by farmers so as to enable them achieve higher productivity on the farms. The transformation of agriculture from the use of traditional inputs (low productivity) to modern inputs (high productivity) is the most serious problem hindering agricultural production in Nigeria. Consequently, the contribution of agriculture to the nation's economy over the years has continued to decline. Food production has therefore failed to meet local demand and has resulted in increased in Nigeria's food import bill (CBN, 2000). This disparity between domestic demand and local production had to be balanced by food importation, to provide the food requirements of the population. According to FAO (2004), Nigeria spent about $0.1million on rice importation in 1970. By 1999, the value of import was $259 million. This means that Nigeria had spent $4 billion on rice importation alone from 1961 to 1999 with an average of $102 million per annum. From the year 2007, about $267 million was spent on rice importation annually (Eke, 2008).

To prevent food importation from consuming an unbearable proportion of the nation's foreign exchange, both military and civilian administrations, have launched a number of programmes to make the country self-reliant in food and fibre production. These include among others the National Accelerated Food Production Programme (NAFPP) in 1973, River Basin Development Authority (RBDAs) in 1973, Nigeria Agricultural and Co-operative Bank (NACB) in 1973, Operation Feed the Nation (OFN) in 1976, Green Revolution Programme (GRP) in 1980, Directorate of Food, Roads and Rural Infrastructure (DFRRI) in 1986, National Agricultural Land Development Authority (NALDA) in 1991 and so on.

In spite of all these programmes and projects, food production has not increased proportionately to meet the need of the Nigerian population. The failure of these and many other policies and programmes necessitates a closer look at the structure of

agricultural organization and problem in Nigeria. Also various research institutes have embarked on developing high yielding varieties of crops and livestock, in order to increase yield per unit area of land. Due to farmers' negative attitude towards improved varieties, adoption of these varieties of crops is becoming a serious problem. The government through extension services has been playing active role of assisting the farmers to adopt these new technologies (Ofuoku, *et al*., 2005).

Various researchers working under different agro-climatic condition reported that productivity levels can be enhanced through the use of improved technology and improvement in the technical efficiency of resource – use like improved seeds and fertilizer. In this regard, the National Cereal Research Institute (NCRI) Badeggi in collaboration with Niger State Agricultural Development Project (NSADP) embarked on by providing rural farmers with improved rice varieties such as FARO 44 (SIPI), FARO 52 (WITA 4), FARO 46 (ITA 150), FARO 48 (ITA 301) and FARO 56 (NERICA 1). In the light of this development, this study was carried out to make comparative economic analysis of adopters and non-adopters of FARO 56 (NERICA 1) among farmers in Paikoro local government area of Niger State, Nigeria.

The specific objectives of this study are to:

(i) examine the socio-economic characteristics of the respondents in the study area;
(ii) determine the costs and returns associated with production of improved and non-improved rice varieties;
(iii) determine the input – output relationship of adopters and non-adopters of improved rice variety; and
(iv) identify the constraints associated with adopters and non-adopters of improved rice variety.

METHODOLOGY

Paiko is the headquarters of Paikoro Local Government Area of Niger State. It is located on latitude 8^{o},20^{l}N and 11^{o},30^{l}N and longitude 3^{o},30^{l}E and 7^{o},20^{l}E and covered an area of 2,259.24 square kilometers. Paikoro Local Government Area falls within the Southern Guinea Savannah region, with an average annual rainfall ranging between 1,100 mm-1,300 mm and the mean temperature of the area is 37^{0}C during the dry season. The Area is endowed with large water bodies such as River Niger, River Gurara, River Chanchaga and numerous streams and extensive flood plains, which offer opportunity for the cultivation of rice crop under irrigation. Other crops grown in the area include maize, sorghum, cowpea, groundnut and yam.

Sampling Procedure

Primary data were collected by administering questionnaires to ninety (90) respondents for the study. Three (3) districts prominent for rice production in Local Government Area were purposively selected for the study. In each of the selected districts three (3) villages were randomly sampled, stratified random sampling was used to select five adopters and five non-adopters of NERICA1 from each of the villages to obtain 45 adopters and 45 non-adopters respectively. In all, ninety (90) rice farmers were interviewed. Data collected include socio-characteristics of the farmers, costs and returns in rice production and problems encountered by rice farmers.

Analytical Techniques

Data collected were analyzed using descriptive statistics, farm budgeting model and Production function analysis. Descriptive statistics were used to analyse socio-economic characteristics of the farmers and problems associated with adopters and non-adopters of the improved rice variety. Gross Margin analysis was used to determine profitability associated with rice production among adopters and non-adopters. Production function analysis was used in determining the input – output relationship of adopters and non-adopters of improved rice variety.

Gross Margin is the difference between the gross farm income (GI) and the Total Variable Cost (TVC). It is a useful planning tool in situation where fixed capital is negligible portion of farming enterprise as in the case of small scale subsistence agriculture (Olukosi and Erhabor, 1988).

GM = GI – TVC

Where:

GM = Gross Margin, GI = Gross Income (Total Revenue),
TVC = Total Variable Cost.

Production function analysis was used to determine the extent to which the inputs used explain the variability in rice output (Olayide and Heady, 1982).

The model in its general form is:-

$Y = F (X_1, X_2, X_3, X_4, X_5, X_6, e)$

Where

Y = Yield of rice (kg), X_1 = Farm size (ha),
X_2 = Hired Labour (₦), X_3 = Quantity of seed used (kg),
X_4 = Family Labour (man-hour),
X_5 = Quantity of fertilizer used (kg),
X_6 = Expenses on agro-chemicals (₦),
e = Error – term

RESULTS AND DISCUSSION

Socio-Economic Characteristics of Adopters and Non- Adopters of Improved Rice Varieties

Socio-economic characteristics of adopters and non-adopters of improved rice varieties which directly or indirectly affect their farming operations in rice production are presented in Table 1. The analysis of results revealed that majority (66.7%) of adopters of improved rice variety was in the age range of 20-30 years, while non-adopters (80%) were within the age range of 41-50years. This implies that the adopters of the improved rice variety are relatively younger than the non-adopters of the improved rice variety and are more likely to try new technology .This is in line with findings of Obeta and Nwagbo (1999) who also noted that younger farmers are more amenable to new ideas and risk; they are expected to adopt innovation more readily than older ones thereby becoming more efficient in rice production. The results also show that 84% of the farmers who adopted improved rice variety were male and only about 16% were female. Adoption of improved rice variety could be as a result of enlightenment campaigns by extension agents. The low adoption rate among female farmers (16%) may be as a result of domestic activities which keep them indoors, thus inhibiting their contact with extension personnel.

Table 1: Socio-economic Characteristics of the Respondents in the Study Area.

	Adopters		Non-adopters	
Variables	**Frequency**	**%**	**Frequency**	**%**
Age in year				
Below 20	04	08.9	04	08.9
21 – 30	30	66.7	02	04.4
31 – 40	04	08.9	09	20.0
41 – 50	02	04.4	27	60.0
51 and above	05	11.1	03	6.0
Total	**45**	**100**	**45**	**100**
Sex				
Male	38	84.4	40	88.8
Female	07	15.6	05	11.1
Total	**45**	**100**	**45**	**100**
Farm size (hectare)				
0.1-1.5	20	44.4	22	48.9
1.6-2.0	13	28.9	16	35.6
2.1-2.5	07	15.6	07	15.6
2.6 and above	05	11.1	00	00.0
Total	**45**	**100**	**45**	**100**
Educational level				
Illiterate	13	28.9	33	73.3
Primary school	17	37.8	08	17.8
Secondary school	09	20.0	04	8.9
Tertiary	06	13.3	00	00.0
Total	**45**	**100**	**45**	**100**
Farm income(₦)				
Less than 50,000	04	8.9	08	17.8
51,000-100,000	8	17.8	16	35.6
101,000-150,000	17	37.8	12	26.7
151,000-200,000	10	22.2	09	20.0
201,000 and above	06	13.3	00	00.0
Total	**45**	**100**	**45**	**100**

Source: Field survey, 2008.

The results further revealed that about 72% of the adopters of improved rice varieties had one form of formal education or the other, while majority (73.3%) for non- adopters had no formal education. Roger and Shoemaker (2001) have observed that education is not only an important determinant of adoption of innovations but also an instrument for successful implementation of innovation for profitability. They also stressed that farmers who have attained some level of formal education are likely to raise their

productivity through wise use of credit. Similarly, Ingye (2005) reported that educational attainment has positive effect on the adoption of farming techniques because it allows farmers to perceive and implement skills acquired from the extension agents.

The size of farm possessed by a particular farm family is believed to determine the extent to which other resources (capital, labour etc) will be utilized for optimum productivity. According to Alamu *et al.* (2002), farmers with more resources including land area are more likely to take advantage of a new technology. The analysis of farmers farm holdings revealed that 44.4% and 48.9% of adopters and non-adopters had farm holdings of between 0.1-1.5 ha respectively. None of the non-adopters had farm holdings up to 2.6 ha. This indicates that majority of the farmers in the study area were small holders. This situation, where many farmers cultivated only small plots of land, will not promote agricultural production beyond subsistence level.

The farm income of a farmer determines his ability to purchase inputs such as fertilize, hired labour, agro-chemicals and improved seeds which bring about increase in outputs. The results revealed that most (37.8%) of the adopters had annual farm income of between ₦ 101,000 to ₦ 150,000 per hectare while most (35.6%) of non-adopters had annual farm income of between ₦ 51,000 to ₦ 100, 000 per hectare.

Costs and Returns Associated with Adopters and Non-adopters of Improved Rice Variety per Hectare.

Analysis of costs and returns revealed that the average variable cost per hectare for adopters was ₦47, 11.5, and gross revenue was ₦95, 462.9 with a gross margin of ₦48, 351.40 per hectare. On the other hand, the average variable cost for non-adopters was ₦22, 958.5 with gross revenue of ₦52, 641.1 and gross margin of ₦29, 682.6 per hectare (Table 2). This revealed that improved rice variety is highly profitable than the local variety in the study area. Among variable costs, the cost of labour and improved seed of adopters accounted for more than 50% of the total cost of production, while costs of seed and fertilizer were the major constituents of the total costs for non-adopters. This suggests that labour input for improved rice producers is the most costly item in rice production in study area. This is in agreement with findings of Hamidu (2001) who reported that labour constituted 65% of the total cost of production in Bauchi State.

Table2: Costs and returns Associated with Adopters and Non Adopters of Improved Rice Varieties

Item (₦/ha)	Adopters	%	Non-adopters	%
Variable Costs				
Cost of labour	28,199.5	59.86	4,342.2	18.91
Cost of fertilizer	6,351.0	13.48	6,200.0	27.01
Cost of seed	8,312.0	17.64	8,111.8	35.33
Cost of Agro-chemical	1,114.0	2.36	1,055.7	4.60
Miscellaneous	3,135.0	6.65	3,149.0	13.75
Total Variable Cost	**47,111.5**		**22,958.5**	
Gross Revenue	**95,462.9**		**52,641.1**	
Gross Margin	**48,351.40**		**29,682.6**	

Source: Field Survey 2008

Regression Analysis Result of Adopters and Non-Adopters of Improved Rice Variety

The results of the estimated production function for adopters and non-adopters of improved rice variety are presented in Table 3. The Semi-log functional form was chosen as the leading equations for adopters and non-adopter respectively. This functional form was selected on the basis of R^2 value, t-value, F-value as well as the signs on the estimated parameters. The coefficient of determination for adopters (R^2) is 0.927, while that of non-adopter (R^2) is 0.65.This means that 92% and 65 % of the variation in the output is explained by the variables included in the model.

The coefficient of farm size (X_1) and fertilizer (X_5) were the significant variables for adopters of improved rice variety. This implies that the farm size and quantity of fertilizer applied will lead to increase in the output of rice. When is applied it improves the fertility of the soil, thereby increasing rice yields. The co-efficient of farm size and agro-chemicals were positive and statistically significant in explaining the output of rice for non-adopters of improved rice variety. This positive and statistical significance of these variables could be as a result of chemical application to rice farm, which is used in the control of weeds and pests in the rice farms, thereby increasing the outputs of rice of non-adopters.

The F-ratio of 23.143 and 11.774 for adopters and non-adopters respectively are statistically significant at 1%, which implies that the explanatory variables included in the model adequately explained the variation in the outputs of rice in the study area.

Constraints Associated With Adopters and Non-Adopters Improved Rice Variety.

The distribution of respondents with regards to the problems militating against the attainment of full potentials of rice production in the study area is presented in Figure 1. The results show that high cost of improved seeds (80%) was the most serious problem encountered by adopters, while 72% reported problem of inadequate finance.

In the case of the non adopters, the serious problem was inadequate finance and lack of extension contact which resulted to lack or little knowledge of improved varieties. Other problem of the non-adopters includes high cost of technology and perceived risk associated with technological changes.

Table3: Result of estimated semi-logged production function for adopters and non-adopters of improved rice varieties.

Variables	Adopters	Non-Adopters
Farm Size (X_1)	434.604 (6.309) ***	179.699 (2.765) ***
Hired labour (X_2)	50.776 (0.445)	-0.568 (-0.651)
Quantity of seed (X_3)	-337.945 (-2.865) **	1.328 (0.539)
Family labour (X_4)	-51.839 (-0.592)	-0.121 (-1.064)
Fertilizer applied (X_5)	425.293 (3.295) ***	1.801(0.965)
Agro-Chemical (X_6)	65.539 (0.927)	0.09123(2.076) *
Constant	-161.765	230.505
R^2	0.927	0.650
Adjusted R^2	0.887	0.595
F-Ratio	23.143***	11.774***

Source: Field survey, 2008
*** implies statistically significant at1%
** Implies statistically significant at 5%
* Implies statistically significant at10%
Values in parenthesis are the t-ratios.

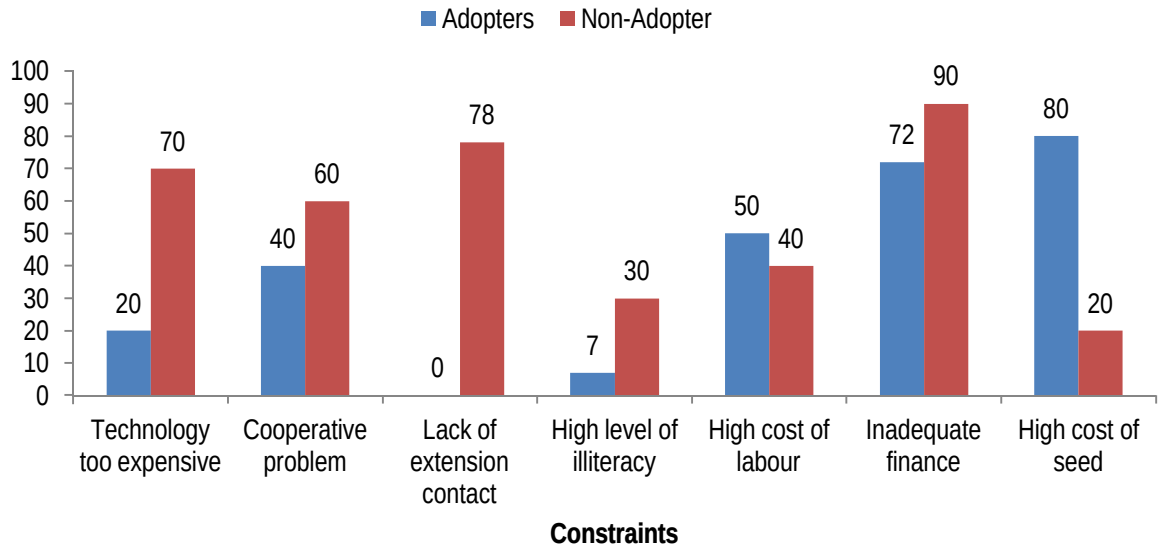

Figure 1: Distribution of respondent based on constraints faced in rice production (%)

CONCLUSION AND RECOMMENDATIONS

The Production of improved rice variety in the area is more profitable than the local varieties. The study also revealed that adopters faced major problem of high costs of improved seeds and labour, and insufficient inputs. Therefore, non-adopters can be motivated to adopt the improved variety by addressing the problems of lack of extension contact, costs of inputs and illiteracy in order to raise the level of adoption among farmers, which will ensure increase in of rice output in the study area.

To improve accessibility to technologies such as improved seeds, fertilizer, agro-chemicals and access to credit, rice farmers in the area should be encouraged to form cooperative societies. Since non-adopters of improved rice varieties reported lack of awareness of some improved inputs, the adoption of such inputs could be enhanced through a more effective extension service.

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