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Full Length Research Paper

Evaluation of factors influencing farmers adoption of irrigated rice production in Fadama soil of North Eastern Nigeria

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This study was conducted at Lake Gerio irrigation project situated at the north western part of Jimeta/Yola, North-Eastern Nigeria. It lies between longitude 12° and 12° 28' east of Greenwich and Latitude 9°16' and 9°19' North of the equator. The objective of the study was to examine the factors influencing farmers' adoption of irrigated rice production. The respondents interviewed were selected using a simple random sampling and purposive sampling techniques proportional to the size of farm. The results obtained shows that five variables have significantly influenced adoption of rice production. These are farming experience, household size, gender, market availability and labour availability. The result of logit regression model shows a statistical significance (P<0.01) of the X_1. It indicates that holding other variables constant, if years of experience increase by a unit, on the average, the logit of the odds in favour of sole rice production increases by 5.33 units. Other variables such as level of education influence adoption as it eases understanding, interpretation and acceptance of the newly introduced techniques. These will enhance purchasing power of materials inputs, like fertilizer, pesticides, improve seeds. Gender also plays a significant role since male genders are more likely to adopt innovation than the female, probably due to the arduous nature of rice production in the project than the female counterparts.

Key words: Influence, rice, adoption, food security, farmers, factors

INTRODUCTION

The Fadama are regarded as rich agricultural areas and contain land and water resources that could easily be developed for irrigation agriculture, (Anon, 1993). These soils make up some of the productive agricultural soils in north east Nigeria for irrigation agriculture, (Ramalan et al., 1998). A major constraint to increased agricultural production in Nigeria is inadequacy of rainfall most especially in the northern states, (Toro, 1997). Large areas of land are left uncultivated, especially in the Sahel region of the north.

The increasing need of crop production for the rising population is causing the rapid expansion of irrigation throughout the world (Farnji and Mahajan, 1996). Average yield of upland and lowland rain fed rice in Nigeria is 1.8 ton/ hectare while that of irrigation system is 3.0 ton/ hectare (PCU, 2002). Previous study conducted reveals that 3.0 ton/ hectare for upland and lowland system and 7.0 ton/ hectare from irrigation system is obtained in places like Cote d'Ivoire and Senegal (WARDA and NISER, 2001).

Irrigation in Nigeria has become an issue of vital importance considering present population growth rate. Virk et al. (2004), noted that Asia's food security depends largely on the irrigated rice fields, which account for more than 75% of the total rice production. Recent report

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shows that population is increasing by 3.5% annually, while food production is increasing by only 2.5% the food and Agricultural Organization for instance, has warned that by the year 2025, Nigeria will no longer produce enough food to feed her self, solely from rain fed agriculture. One of the complimentary measures that could be taken is to intensify irrigated agriculture (Abubakar, 2001). To assure food security in the rice consuming countries of the World, rice production would have to be increased by 50% in these countries by 2025 and, this additional yield will have to be produced on less land with less usage of water, labour and chemicals (Zeng et al., 2004). According to Amaza and Tashikalma (2003), the literacy level of farmers is important as it determine the rate of adoption of improved technology for increased productivity. Cochrane (1993) and Vanclay (1992) observed that adoption of technology is not easily predicted solely on its potential economical benefits. Other factors affect farmers' decisions to adopt new technology. Conversely, Adrian et al. (2005) found that the farmers' perceptions of net benefit affected the intention to adopt other production pertain.

Adequate and efficient irrigation provides a reliable employment, increase cropping intensity, increase yield per hectare and eventually generate more income, hence, high standard of living for the farmer. Villano and Fleming (2004), noted that more adult members in a household means that more quality labour would be available for carrying out farming activities in time and thus increasing productivity. Muhammad (2000) in his previous study observed that these Fadama area creates employment for 1,400 families on an area of 350 hectares, in addition, it created economic activities to 800 men and women who purchase and retail vegetables, rice, fresh maize corn, sweet potatoes, etc during the dry months of the year. He further revealed that yield of 7.8 tons of paddy rice and 11.5 tons of amaranths were obtained under irrigation. In a study conducted by Adewuyi and Okunmadewa (2001), it is observed that there is a positive relationship between access to extension services and efficiency of farmers' productivity.

Presently, there was no any research work or comprehensive information regarding the factors influencing farmers' adoption of irrigated rice production in this Fadama area. Despite the fact that irrigation agriculture is capital intensive and labour expensive, the farmers seem to persist on irrigated rice cultivation. It was also observed that even though the average land holding of a farmer was half a hectare, farmers seem to adopt similar crops for many years without diversification. These farmers a times loose their crops due to quilea bird invasion, but yet persist on production. Thus, this study was carried out with the general objective of analyzing the factors influencing farmers' adoption of irrigated rice cultivation by small-scale dry season farmers in Fadama soils. The specific objectives were:

i. Determine the factors influencing adoption of irrigated rice cultivation and problems in its adoption
ii. To estimate the cost and returns of paddy rice cultivation

METHODOLOGY

Study area

The study area was situated at the North-Western part of Jimeta, Yola in Adamawa State, North Eastern Nigeria. It lies between longitude 12° and 12° 28′ east of Greenwich and Latitude 9°16′ and 9°19′ North of the equator. The area is between 150 and 180 m above sea level. It is bounded in North-East by the River Benue, Jimeta in the South West and Namtari Forest Reserve on the West. It covers an area of 850 hectares with only 320 hectares currently under cultivation, accommodating 640 beneficiaries (Team Planning International, 1992).

Sample size and sampling procedures

The respondents (farmers) interviewed were selected using a simple random sampling and purposive sampling techniques, proportional to the size of the farm. A sample of 120 farmers formed the sample size. The area was divided into four phases, namely; phase IA (60ha), IB (50 hectare) and IIA (40 hectare) IIB (260 hectare). The average holding of individual farmer was half a hectare. At the end of data collection only 104 questionnaires were correctly filled and returned. The remaining 16 were rejected owing to inconsistencies in their responses.

Analytical techniques

Descriptive statistical analyses such as frequency and percentage were carried out on problems encountered by the farmers. The gross margin analysis was used to estimate the costs and returns associated with rice production in the study area.

GM =G1–TVC - - - - (1)

Where;
GM = Gross margin
GI = Gross income
TVC = Total Variable Cost

The item of farm income considered was cash receipts from the sales of paddy and the value of the part of the output consumed by the farmer's household. The items of variable costs considered include costs of production inputs as seed, fertilizer, herbicide, irrigation, transport and empty bags as well as labour cost. For proper accounting, family labour was valued where employed. Following Shehu (2007), the family labour employed was first converted to man-hours using a factor 1 for matured adult males, 0.75 for matured females and 0.50 for children (14 years and above) and then finally to man days by dividing the man hours by eight.

Logistic regression model

Farmers' adoption of irrigated rice production was studied using logit model. This study utilized logistic regression model to empirically quantify the relative influence of various factors in the decision of the respondents to adopt this method. The relationship of this dependent variable can be examined with the independent

Table 1. Maximum likelihood estimates of factors that influence the adoption of sole rice enterprise.

Variable	Logistic regression coefficient	Standard error	Significance	Exp(β)
Farming experience (X_1)	0.533*	0.304	0.080	1.355
Household size (X_2)	- 0.065 ***	0.024	0.007	0.937
Education (X_3)	0.052	0.038	0.171	1.050
Gender (X_4)	2.012 **	0.867	0.020	7.478
Market availability (X_5)	1.432 **	0.638	0.025	4.187
Labour availability(X_6)	0.682 ***	0.245	0.005	1.978
Constant	1.768	1.776	0.320	5.856

x^2 = 95.246 (P<0.01), -2 log likelihood =97.245 (P<0.01), Negelkeke R^2 = 0.953, *** Significant at 1%, ** Significant at 5%,* Significant at 10%.

variables. Thus, the logistic regression model has been specified as Equation (2):

$$L_i = \left(\frac{P_i}{1-P_i}\right) = \alpha + \beta_1 x_1 + \beta_2 x_2 \ldots\ldots + \beta_6 x_6 + e_i \quad (2)$$

Where;

L_i = Logit or log of odds ratio

P_i = Adoption of sole rice production

$1 - P_i$ = Adoption of any other crop production

α = Constant term

B_i to B_6 = Coefficients to be estimated

e_i = distribution term.

X_1 = Farming Experience (years)

X_2 = Household size (number of persons in a household)

X_3 = Education (number of years of formal schooling)

X_4 = Gender (binary variable, 1 = male, O = Female)

X_5 = Market availability (binary variable, 1 = if Yes, o if No)

X_6 = Labour availability (binary variable, 1 = if Yes, O = if No)

The parameters in equation (2) were estimated using statistical package for social sciences (SPSS 13) computer software.

Estimated logistic regression function

The Statistical Package for Social Sciences (SPSS) was used to estimate the empirical model using maximum likelihood estimation method. From the results obtained the coefficient, which is a measure of effect size shows that the effect of education was minimal, while the effects of farming experience were high to certain extent (Table 1). The results of the logistics regression model also indicates that the fit of data was good as indicated by the statistical significance (P<0.01) of the X^2. The parameter estimates that five (5) variables significantly influenced the choice of sole rice enterprise. These include farming experience, household size, gender, market availability and labour availability.

The coefficient of farming experience was 0.533 (P< 0.10) indicates that, holding other variables constant if years of farming experience increase by a unit, on the average, the logit of the odds in favour of sole rice enterprise increase by 0.533 units. The effect of farming experience on adoption of sole price enterprise could be due to the farmer's managerial ability, conviction and understanding of the potentials of the enterprise as a result of many years of farming.

Household size showed a significant (P<0.01) But inverse effect on adoption of sole rice enterprise. The significance of the variable could be due to the fact that as family size increases farmers tends to have and use more family labour which invariably reduces cost of production. The negative coefficient might be unconnected with the fact that the farmers had a lot of dependent to feed; hence, little money is left to be used to produce material inputs such as improved seed varieties and fertilizer, which are very important determinants of output in rice production.

There is high tendency of male farmers to adopt the sole rice enterprise than females. The odd ratio {Exp (β)} for the gender variable was 7.478 which suggest that male farmers where seven (7) times more likely to adopt sole rice enterprise than the female farmers. This result is true because men have more ability to endure the arduous task associated rice enterprise than women; hence, they are likely to dominate the business.

The results of the logit model also reveals that on the average, 68% of the farmers would adopt sole rice enterprise as labour availability increase, ceteris paribus. Rice production enterprise is laboured extensive; hence, availability of labour is critical for it to succeed.

COST AND RETURN ASSOCIATED WITH RICE PRODUCTION

Analysis of cost and returns revealed per hectare production cost of N167, 032.84. The labour constituted about 57% of the Total Cost of production suggesting that labour is an important resource in rice production (Table 2). These agreed with the findings of Chikwendu and Tologbonse (1999) and Shehu (2007) who both reported that human labour was the most significant cost item in rice production.

An average of 7,513.93 Kg of paddy rice per hectare was harvested from the farmers field. Therefore at an average prevailing price of N35.00 per Kg of paddy rice the total value of production was N270, 501.12. The N gross margin per hectare was N92, 668.14. based on the assumption that fixed inputs are negligible, the investment was 52 Kobo which means that for every One Naira invested the farmer got extra 52 Kobo. Going by that and taking into consideration the investment duration which is about 3.5 – 4 months, the venture could be said to be economically worthwhile for investment.

Table 2. Average cost and return per hectare from irrigated rice production in Lake Gerio irrigation project.

Item	Unit	Price/Unit (₦)	Quantity(kg)	Value (₦)
A. Rice output	Kg	35	7,513.92	270,501.12
B. Capital operating inputs:				
Seed	kg	50	80	4,000
Fertilizer	kg	50	600	30,000
Herbicide	litre	1,200	4	4,800
Irrigation cost	N/Month	5,000	4	20,000
Other capital operating inputs (empty bags, transport, etc)	N			18,400
Total				77,200
C Labour input:				
Land clearing	Man /days	466.64	6	2799.84
Nursery	Man /days	5000	1.2	6,000.00
Tillage	Man/ days	896.72	11.3	10,132.94
Herbicide application	Man /days	1,250	2	2,500.00
Transplanting	Man /days	1,000	18	18,000.00
Fertilizer	Man /days	2,400	5	12,000.00
Weeding (supplementary)	Man/ days	514.3	14	7,200.20
Harvesting (cutting and threshing)	Man /days	750	56	42,000.00
Total				N100,632.98
D. Total variables cost (B + C)				N177,832.98
E. Gross margin (A – D)				N92,668.14
F. Return on investment (E/D)				0.52

Table 3. Problems encountered by the farmers.

Problems	Frequency	Percentage
Quilea birds invasion	55	52.88
Insect pest invasion	14	13.46
Diseases outbreaks	8	7.69
Flood	11	10.57
Lack of enough land	98	94.23

Problems Faced by the Farmers

About fifty three percent of the respondents found to be having quilea bird invasion on their rice farms at heading (Table 3). They usually engage hired and family labour mostly school children for scaring the birds for the period of four weeks before the grains become fully ripened. Another problem militating against farmers is lack of enough developed irrigated land for expanding their farm size. The high cost of operation and maintenance is one of the problems faced by the irrigation agency. Pest and disease infestation also interferes with growth of rice crop resulting into reduction of yield per hectare. Annual flooding tends to erode the irrigation structures and as well bring in some obnoxious weeds (water hyacinth) covering water bodies, canals farm lands, pumping intake.

CONCLUSION

From the findings of the study it can be concluded that the choice of irrigated rice production depends mainly on the availability of market and labour. Also, worthlessness of a venture is a major determining factor. Efforts geared towards improving the availability of labour and market

would enhance the adoption of irrigated rice enterprise.

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