PROFITABILITY AND SOCIO-ECONOMIC ANALYSIS: EVIDENCE FROM RICE PRODUCTION IN LAKE GERIYO OF ADAMAWA STATE, NIGERIA

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Muhammad Auwal Ahmed
Department of Agricultural Economics & Extension, Modibbo Adama University of Technology, PMB 2076, Yola, Adamawa State, Nigeria
auwalyounky@gmail.com

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Abstract: This study examines rice production in Lake Geriyo of Adamawa state, Nigeira. The study describes the demographic profile of the farmers, determines their profitability, examines the effect of farmers' demographic profile on rice output as well as the constraints hindering rice production in the area. Descriptive and inferential statistics were used to analyze the data. The descriptive statistics revealed that majority of the farmers (69.15%) were male, 40.43% ranges between 41–50 years, while 96% of them were married, 89.36% are educated with a mean experience of eight years. Costs and returns analysis revealed that the average variable cost per hectare was ₦86,020, while the total fixed cost was ₦8,450 with a gross margin of ₦103,273 and a net farm income of ₦94,823 which indicates that rice farming in the area is a profitable venture. The regression analysis shown that education, household size, farming experience and man-days of labour were positive and statistically significant at varying probability levels and hence influenced rice output. The coefficient of determination (R^2) showed that about 68.29% of the variation in output was explained by the independent variables used in the model whereas the remaining 31.71% was accounted for by error term. However, high cost of agrochemicals, inadequate credit facility and high cost of labor were the major constraints confronting farmers. The findings recommend that experience and educated rice producers should be encouraged by government via workshops to share their skills with young farmers in order to enhance their knowledge and increase their output and profit levels.

Keywords: Adamawa, gross margin, net income, regression, rice

Introduction

Rice ***Oryza*** *sativa* is a staple cereal grain which is widely consumed in most part of human population in the world, especially in Asia and the West Indies. It is the grain with the second-highest production worldwide, after maize (FAO, 2016). Rice is the vital nutrition of most human population in Asia, Latin America, the Caribbean and Africa. It is central to the food security of over half of the world population. Developing countries accounts for 95% of the total production, with China and India alone responsible for nearly half of the world output. It provides 20% of the world's dietary energy supply, while wheat supplies 19% and maize 5% (FAO, 2018).

In Nigeria, the total cultivated land mass is estimated at 82 million hectares whereas the area suitable for paddy cultivation was estimated at 4.6 million hectares or only 39% is currently utilized. The country is also blessed with untapped (3.14 million) hectares of land suitable for rice irrigation but only about 50,000 hectares is currently in use. The annual national demand for rice is 5 million tons, while the annual production stood at only 3.78 million tons as at the year 2019 (Nneka *et al*., 2019). The demand for rice in Nigeria has been soaring speedily at an estimated rate of 10% per annum (NRDS, 2009), due to population growth, increased income levels and urbanization (USDA, 2018). An average Nigerian now consumes 24.8 kg of rice per year representing 9% of the total calorie intake (FAO, 2017).

According to Odoemenem & Inakwu (2011), rice is mainly consumed in its parboiled form which adds value to its production and consumption chain. It can be used in form of fermented sweet rice, noodles, pastries, puffed rice and in making wine, spirit and vinegar. Rice is an increasingly important crop in Nigeria. It is relatively easy to produce and is grown for sale and for home consumption. However, Ohen & Ajah (2015) observed that rice production is deterred by high cost of inputs like cost of credit, imported equipment, agrochemicals due to taxes among others. In lieu of the importance of rice, this study examined the effect of socio-demographic profile of farmers on rice output, their profitability and the constraints hindering rice production in Lake Geriyo.

Materials and Methods

This section describes the sampling technique, data collection process, data analysis and the models used to analyze the data.

Study area

The study was conducted in Lake Geriyo, Yola North Local Government Area of Adamawa State. Lake Geriyo is located on latitude 09° 18N and longitude 12° 25E and occupies natural depression near the upper River Benue in the north eastern Nigeria. It is a shallow water body of about 250 hectares in size with a mean depth of about 3 meters. Aquatic vegetation on the lake consists of water spinach, water hyacinth, water Lilly and water lettuce which move around the lake surface due to the prevailing wind. The area experiences two distinctive wet and dry seasons. The wet season starts from May to October, while the dry season commences from November to April with a mean daily temperature which ranges from 25 to 45°C and the mean annual rainfall received is in the range of 150–1000 mm (Ekundayo *et al*., 2014).

Sampling procedure

Rice producers in Lake Geriyo Adamawa State were the target respondents for the study. The lake is located on latitude 09° 18N and longitude 12° 25E near the upper River Benue in the north eastern Nigeria. The area experiences two distinctive wet and dry seasons. The wet season starts from May to October, while the dry season commences from November to April. The mean daily temperature fluctuates with season from 25 to 45°C with a mean annual rainfall which ranges from 150–1000 mm. Simple random sampling technique was used to select ninety-four (94) respondents whose relevant responses were obtained through structured questionnaire administered face-to-face and then used for the analysis.

Analytical techniques

Data collected from the farmers were subjected toboth descriptive and inferential statistics. Descriptive statistics such as percentages, frequency distribution and simple meanwere used to analyze socio-economic characteristics of the respondents whereas inferential statistics such as Cobb-Douglas production function was used to test the effect of socio-economic characteristics of farmers on rice yield.

Model specification

The explicit form of Cobb-Douglass production function is given by:

$$Ln(Y) = \beta o + \beta_1 LnX_1 + \beta_2 LnX_2 + \beta_3 LnX_3 + \beta_4 LnX_4 + \beta_5 LnX_5 + \beta_6 LnX_6 + \beta_7 LnX_7 + U_i \quad (1)$$

Where: Y = output of rice (kg); X_1 = Age (years); X_2 = Gender (male, female); X_3= Farming experience (years); X_4 = Household size (number); X_5 = Size of farm land (hectares); X_6 = Education (Dummy: 1 = educated, 0 = otherwise); X_7 = Labor (man-days); β_o = constant; β_1 –β_7 = Estimated parameters; $\mu_i = Error term$

Gross margin (GM) by definition is the difference between the gross income and the total variable cost. It is expressed as follows:

GM = GI – TVC (2)

Where: GM = Gross margin (₦); GI = Gross income (₦); TVC = Total variable cost (₦)

Net Farm Income (NFI) is defined as the difference between gross margin and total fixed cost. It is given by;

NFI = GM - TFC (3)

Where: NFI = Net Farm Income (₦);
TFC = Total Fixed Cost (₦)

Fixed cost was determined using straight line method of depreciation.

Results and Discussion

Socio-economic characteristics of the respondents

Table 1 shows the results on socio-economic characteristics of rice farmers which include gender, age, household size, marital status, farming experience and education level. The finding reveals that 69.15% of the respondents were male, while only 30.85% were female. This indicates that men mostly embark on rice production activities in the area primarily for the reason that it is labour demanding and male are resilient and can work for longer hours than their female counterparts. The mean age of 34 recorded by men indicates that majority of the respondents were in their fruitful ages and could put in their best in their farming activities. Majority of the respondents (75.53%) were married with only 9.57% being single signifying that they are responsible as they have family to manage apart from their farming industry.

The finding disclosed that 89.36% of the respondents accomplished one form of education or the other, while about 10.64% attended non-formal education. This denotes that education might have positive influence on the way farmers utilize their farm inputs and in the adoption of new innovations as well. The mean years (8) of farming experience implies that the farmers have experience in rice production and could harness the good practices involved and therefore, tend to be more proficient than those with less experience. It was also found out that the respondents had a mean household size of six (6) members. This mean that large number of people per household can bring about increase in rice yield as it could be a sign of household's ability to have numerous information sources that can influence profit. This result is in line with the findings of Girei *et al*. (2013), Ohen & Ajah (2015) and Nneka *et al*. (2019).

Table 1: Socio-demographic profile of the farmers (N = 94)

Variable	Frequency	Percentage (%)
Gender		
Male	65	69.15
Female	29	30.85
Education		
Non-formal	10	10.64
Primary	23	24.47
Secondary	43	45.74
Tertiary	18	19.15
Age		
Mean	34	
21 – 30	18	19.15
31 – 40	29	30.85
41 –50	38	40.43
> 50	09	9.57
Experience		
Mean	08	
1 – 5	28	29.79
6 – 10	36	38.29
11 – 15	17	18.09
> 16	13	13.83
Household size		
Mean	06	
1 – 5	32	34.04
6 – 10	45	47.87
> 11	17	18.09
Marital status		
Married	71	75.53
Single	09	9.57
Divorce	03	3.19
Widow	07	7.45
Widower	04	4.26

Source: Field survey (2019)

Table 2: Average costs and returns of rain fed rice production per hectare

Production inputs	Value (₦)	Percent (%)
Variable inputs		
Seeds	10,000	11.63
Sacks	3,520	4.09
Fertilizer	19,500	22.67
Herbicides and pesticides	8,000	9.30
Labor	25,000	29.06
Rents on land	20,000	23.25
Total variable costs	**86,020**	**100**
Fixed inputs		
Hoes	1,100	
Sickles	1,000	
Wheel barrows	5,450	
Rakes	1,000	
Total fixed costs	**8,450**	
Total costs of production	**94,470**	
Total revenue	**189,293**	
Gross margin	103,273	
Net farm income	94,823	
Return per naira invested	1.09	

Source: Field survey (2019)

Analysis of costs and return in rice production per hectare

This was computed using gross margin and net farm income techniques as presented in Table 2. The results showed that total variable cost expended on inputs was ₦86,020, while total amount of money spent on fixed cost was ₦8,450 and the total cost of production recorded ₦94,470. The high cost of production could not be dissociated with the high cost of inputs such as labour, land, fertilizer, seeds and agrochemicals. The total revenue accrued to the farmers was

₦189,293; with a gross margin of about ₦103,273 and a net farm income of ₦94,823 which implied that rice farmers were not operating at loss and that it is a profitable venture in the study area. The findings corroborate with that of Abdullahi (2012), Muhammad *et al*. (2015) and Ahmed (2019) who in their various study areas reported that rice farming is a profitable business.

Analysis of socio-economic factors influencing rice yield

Regression analysis was run to determine the relationship between socio-economic characteristics of rice farmers and that of their output as presented in Table 3. Cobb-Douglas production function was adopted based on the economic, econometric and statistical criteria. The result shows that variables Age, years of experience, farm size, labour and education were statistically significant at varying levels of probability, while household size and gender were not statistically significant at the prescribe levels of probability. The R^2-value of 0.65 implies that 65% of the variation in rice yield is being accounted for by the independent variables used in the model, while the remaining 35% is being accounted for by error term. The corresponding probability value of F-statistic is 5.93 implying that it is statistically significant at 1% level. However, this also means that all the independent variables used in the model jointly influence the dependent variable, and that the data adequately fit the model.

The result shows that age is positive (0.771) and statistically significant at 1% level of probability. This means that a 1-year increase in the age of respondents would lead to an increase in their total yield by about 0.771%. Similarly, man-days of labour is positive (14.268) and statistically significant at 1% level of probability. This implies a unit increase in man-days of labour would eventually increase the total revenue of respondents by 14.268%. The result also shows that years of farming experience is positive (1.219) and statistically significant at 5% level of probability, that means the respondent's years of experience influences rice yield realized by 1.219%. Also, farm size is positive (0.617) and statistically significant at 1% level of probability. This implies that a hectare increase in farm size would lead to an increase in rice yield by about 0.617% as farmers tend to drive the benefit of economies of scale. The coefficient of education (0.256) is positive and statistically significant. This means that a year increase in the educational level of farmers would lead to a corresponding increase in rice yield by 0.256%. Education influences farmers' adoption of agricultural innovations and also improves decision making on various aspects of farming. The result supports the findings of Abdullahi (2009), Odoemenem & Inakwu (2011), Begum *et al*. (2013) and Ahmed *et al*. (2017).

Table 3: Results on the analysis of socio-economic factors influencing rice yield

Variable	Coefficient	Standard Error	t-Statistic
C	0.093637	0.180333	0.5192^{NS}
Labour	14.26794	1.251634	11.3996^{***}
Household size	0.037804	0.153545	0.2462^{NS}
Farm size	0.616545	0.143595	4.2937^{***}
Years of experience	1.218763	0.219047	5.5639^{**}
Gender	0.034731	0.218340	0.1591^{NS}
Education	0.256437	0.084781	3.0247^{**}
Age	0.771240	0.2132745	3.6162^{***}
R-squared (R^2)	0.65		
Adjusted R^2	0.62		
F-Value	5.93^{***}		

Source: Field Survey (2019)

***, ** and * = Significant at 1 and 5% levels of probability; NS= Not significant

Table 4: Problems faced by rain fed rice farmers in the study area

Problems	Frequency	Percentage
Cost of agrochemicals	38	15.14
Inadequate credit facility	35	13.03
Cost of labor	33	12.01
Lack of improved seeds	31	11.97
Extension contact	31	11.70
Price fluctuation	30	11.43
Pests and disease infestation	29	8.95
Unfavorable government policies	29	8.41
Unfavorable climatic factors	28	7.36
Total	**284***	**100**

Source: Field survey (2019); *Multiple responses exist

Constraints associated with rice production

Rice growers in the study area are faced with various constraints ranging from lack of improved seeds to cost of labor. The analysis in Table 4 indicated high cost of agrochemicals (15.14%), inadequate credit facility (13.03%) and high cost of labor (12.01%) as the major constraints affecting rice production. This is followed by lack of improved seeds (11.97%), extension contact (11.70%) and price fluctuation (11.43), while others include pests and diseases (8.95%), unfavorable government policies (8.41%) as well as climatic factors (7.36%).

Conclusion

Based on the findings of this research, it could be concluded that rice production in the study area is a profitable agricultural enterprise. The regression analysis established that years of farming experience, man-days of labour, education and farmers' age had positive and significant relationship with rice yield. The study therefore recommends the following:

1. Rice producers should be educated on how to manage farm inputs through organizing of workshops and seminars as this will reduce production costs and increase profits.
2. Government in collaboration with community leaders should make farm lands available to farmers at a subsidize rate as this would enable them to benefits from economies of scale and increase their output level.
3. Young farmers should learn how to apply the new techniques from the experience and educated ones in order to increase their output and profit levels.

Conflict of Interest

Authors have declared that there is no conflict of interest reported in this work

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