

Profitability Analysis of irrigated Rice (*Oryza Sativa L.*) Production in Lake Gerio, Yola North Local Government Area of Adamawa State, Nigeria

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DOI: <https://doi.org/10.51244/IJRSI.2024.1108102>

Received: 30 August 2024; Accepted: 06 September 2024; Published: 14 September 2024

ABSTRACT

The study examined the profitability of irrigated rice (*Oryzasativa L.*) production in Lake Gerio, Yola North Local Government Area of Adamawa State, Nigeria. The underlying objectives of the study were to; describe the socio-economic characteristics of irrigated rice farmers in the study area, determine the costs and returns associated with irrigated rice production and identify the constraints associated with irrigated rice production in the area. Simple random sampling technique was used to select 83 irrigated rice farmers. Data obtained were analyzed using descriptive statistics and gross margin analysis. The result revealed that irrigated rice production is a viable venture as farmers earned a total revenue of N 646,235.66 and a gross margin of N176,037.85 per hectare respectively. The return on every Naira invested was N1.37k with operation ratio of 0.73. It was further revealed that majority (78.3%) of the respondents were male, 60.02% were within the age of 31-50 years, 73.5% were married, majority (82%) of the farmers having a large household size, 76% of the farmers have attained one form of education or the other and 76.6% of the respondents had farm size ranging from 0.1-1.5ha. Also, the major constraints that farmers encountered were poor access to loan, low market prices, limited farm size, grazing by animal, bad road network and high cost of fertilizer among others. The study recommends that financial institutions and stakeholders in the agricultural sector should ease farmers access to farm credit so that they can expand production and also generate more jobs to our teeming unemployed youths, government should reinstate the agricultural price policy in other to overcome the problem of low market price, farmers are encouraged to form to cooperative association so that they can interact with one another, inputs like; fertilizer, hybrid seed and agrochemicals should be subsidized and delivered to farmers timely to improve productivity and efficiency.

Key words: Profitability, Irrigated Rice, Operation ratio, Return on capital invested

INTRODUCTION

Rice (*Oryza sativa L.*) is one of the primary staple crops and the source of half of the calories for nearly 50% of the world's population. Rice is a famous staple food which is a large proportion of the average household diet (Ahmed et al., 2016; Achichiet al., 2023). Rice is a valuable cereal crop that is grown and consumed all over the world. It is a staple dish in various African countries, including Nigeria, where it accounts for a significant amount of the diet on a regular basis (Luet al., 2018; Adangara et al., 2022). The global demand for rice is anticipated to increase by 28% by 2050 (Temitokpeet al., 2022)

In Nigeria, significant progress has been recorded as rice production reached a peak of approximately 5

million Metric Tons and the country experiences illegal importation on annual basis (FAO, 2020). Despite this improvement, comparatively, Nigeria’s rice statistics suggest that there is an enormous potential to raise productivity and increase production. The level of growth recorded in rice production over the years in Nigeria has been achieved due to an increase in the area of land under cultivation for rice. The size of land area which is under rice production has expanded from 2.4 million hectares that was harvested in 2010 to 3.2 million hectares harvested in 2017 (PWC, 2018). Yields have remained at 2 tons per hectare, which is about half of the average achieved in Asia (FAO, 2020). According to Thrive Agric (2020), food production increases have not kept pace with population growth resulting in rising food imports and declining levels of national food self-sufficiency. Rice production is mostly dominated by smallholder farmers in Nigeria who are cultivating small hectares of farm land using rudimentary and the traditional systems and methods of farming techniques; crop yields are very low per hectare and hence creating a wider gap of demand and supply, (Aboaba, 2020).

However, the cultivation and production of this highly accepted and well-priced and very important food crop is dwindling. The primary goal of any investment is to ensure successful production that will guarantee the existence of the business not only by yielding positive returns but to maximize the gain arising from the production process. Hence the study set out to investigate into profitability analysis of irrigated rice production in Lake Gerio, Yola North Local Government Area of Adamawa State, Nigeria. Specifically, the study addressed the following objectives to: describe the socio-economic characteristics of irrigated rice farmers in the study area, estimate the costs and returns associated with irrigated rice production and identify the constraints associated with irrigated rice production.

METHODOLOGY

The study area

The study was conducted in Lake Gerio, Yola–North Local Government Area of Adamawa State, Nigeria. It lies between longitude 12°00’ 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 the North-East by the River Benue, Jimeta in the South West and Namtari Forest Reserve on the West.

Sampling Techniques

Irrigated rice farmers are the targeted population for this study. Simple random sampling technique was used for the study. The number of registered rice farmers was obtained from the farm manager of Lake Gerio during preliminary survey and was used as the sampling frame. The total number of registered rice farmers was 501. The rice farmers were distributed in three (3) blocks (2B, 2C, and 3B) respectively. Taro Yamane (1967) formula was used to obtain the sample size from the sampling frame which is eighty-three (83). Random sampling technique was employed to select the respondents proportionate to the population of farmers in each block (Table 1).

Table 1: Sampling Frame and Sample Size for the Study

Sections	Farm Size (hectares)	Sampling Frame	Sample Size
2B	50	247	41
2C	24.4	121	20
3B	26.6	132	22
Total	101	500	83

Source: Field survey, 2023.

Taro Yamane's formula (1967)

$$n = \frac{N}{1+N(e)^2} \dots\dots\dots (1)$$

n = sample size

N = population size

e = level of precision or sampling error (which is 0.10 or 10%)

$$n = \frac{500}{1 + 500(0.10)^2}$$

n = 83

Analytical Techniques

Frequencies, percentages and mean were used to analyze the socio-economic characteristics of the respondents (objective i), and the constraints to irrigated rice production in the study area (objective iii), while gross margin analysis (GM) was used to estimate the profitability of irrigated rice production in the study area (objective ii).

Gross Margin Analysis

Gross margin represents the difference between the monetary value of all the output per hectare (gross returns) and total variable cost per hectare (Jonguret al.,2010). The gross margin analysis was used to determine the cost and returns associated with irrigated rice production(objective ii).

$$GM = TR - TVC$$

Where:

- **GM** = Gross margin (N/ha)
- **TR** = Total revenue (N/ha)
- **TVC** = Total variable cost (N/ha)

The gross margin analysis was used under the assumption that fixed cost of production is negligible.

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

The socioeconomic characteristics of interest here include; age of the respondents, sex, family size, marital status, literacy level, farm size and contact with extension agent.

The result in Table 2 on age distribution of the respondent shows that most (60.2%) of the respondents were within the age range of 31-50 years, while only 8.4 % of them were 60 years and above. The maximum age was 70 years and the minimum age was 20 years with a mean age of about 42 years. This finding therefore revealed that majority of the farmers in the study area are relatively young and their youthful strength can be effectively utilized in the production process, which is in line with the findings of Maduguet al., (2017) in their study on Economics of Rice Production in Mubi-North Local Government Area of Adamawa state, which posited that farmers who fall within such age ranges are in their economic active years of production.

Table 2: Socio-economic Characteristics of the Respondents (n =83)

Age Distribution		
Age (years)	Frequency	Percentage (%)
≤30	15	18.1
31-40	23	27.7
41-50	27	32.5
51-60	11	13.3
≥61	7	8.4
Mean	42	
Max.	70	
Min.	20	
Sex Distribution		
Sex	Frequency	Percentage (%)
Male	65	78.3
Female	18	21.7
Marital Status		
Marital Status	Frequency	Percentage (%)
Single	14	16.9
Married	61	73.5
Divorced	3.00E+00	3.6
Widowed	5.00E+00	6
Family Size Distribution		
Family Size (persons)	Frequency	Percentage (%)
1-5	15	18
6-10	3.30E+01	39.8
11-15	2.10E+01	25.3
16-20	11	13.3
≥21	3	3.6
Mean	10	
Max.	27	
Min.	3	

Source: Field survey, 2023

Majority (78.3%) of the farmers were male which implies that there are more male farmers than female farmers engaged in irrigated rice farming in the area. This could be attributed to the tedious nature of the various activities before rice is fit for consumption as posited by Adejohet al. (2017) in their study on assessment of the adoption of improved Riceprocessing technologies in the federal capital territory, Abuja, Nigeria. The result further revealed that most (73.5%) of the rice farmers in the study area were married, 16.9% were single while 3.6% and 6.0% were divorced and widowed respectively. This implies that married farmers are more “advantaged” in agricultural production and improved agricultural technology adoption because spouses and children of married farmers may likely constitute the major labour force in rice production as posited by Onyeke (2017) in his study on determinants of adoption of improved technologies

In rice production in Imo state, Nigeria. The result on family size of the respondents in the study area revealed that about 39.8% of the respondents had 6-10 people in their household, 25.3% had 11-15 people and 18.0% had 1-5 people. The mean family size was 10 people while the maximum and minimum number of people per family was 27 and 3 respectively. However 16.9% of the farmers had more than 16 people in their household. This implies that rice farmers in the area have considerable family labour as posited by Onyeke (2017) in his study on Determinants of Adoption of Improved Technologies in rice Production in Imo state. Family labour is important in rice production as it reduces the amount spent on hired labor (Garbaet al., 2011).

The result in Table 3 shows the literacy level of the respondents in the study area, majority (80.7%) of the respondents had some form of formal education and hence will possibly be innovative. Thus, the bulk of the farmers is somewhat educated and can presumably interact to generate new ideas to changing conditions in rice production. This is substantiated by Onyeke (2017) who observed that high literacy level could have positive impact on the adoption of Agricultural technologies. About 24.1% of the farmers had farming experience of 6-10 years, 33.8% had between 11-15 years and 16-20 years, 10.8% and 31.3% had between 1-5 years and >20 respectively. The mean farming experience was 17 years and the maximum was 40 years while the minimum experience recorded among the respondents was 2 years. This implies that experience is important in determining the profit levels of farmers. The more the experience, the more farmers understand the farming systems, conditions, trends etc. This is in agreement with Maurice et al., (2015) who reported that years of farming experience improve productivity and overall efficiency in food crop production in their study on Analysis of Technical Inefficiency in Food Production Systems among Small-Scale Farmers in some Selected Local Government Area of Adamawa State.

The result on sources of labour used in irrigated rice farming in the study area revealed that most of the respondents (50.6%) relied on both family and hired labour, 39.8% used hired labour while 9.6% used only family labour. The implication is that labour is likely to be readily available in the area which will in turn lead to increase in output and profit. This is in agreement with Rahji (2005) who pointed out that availability of quality labour is highly correlated to production efficiency. The result on respondents' sources of capital for irrigated rice farming activities revealed that majority (65.1%) of their capital came from personal savings, 27.7% through borrowing from friends and relatives, and 4.8% from Micro Finance Bank while only 2.4% from obtained loan from Bank of Agriculture. This implies that the farmers in the area had poor access to formal farm credit. Given the fact that majority of the farmers in Nigeria are poor, the implication of this is that there is little chance for acquiring quality inputs as well as expansion of the farm holdings, consequently reducing their efficiency. This in agreement with findings of Idachaba (2006); Deaton (1997); Zeller (1994); and Udry (1990) who asserted that poor access to formal farm credit constitute a major constraint militating against the rural farmer's agricultural productivity. Similarly, Petrick (2005); Sial and Carter (1996) and Federet al. (1990) found that lack of access to credit facility poses significant adverse effects on farm output.

Table 3: Additional Socio-economic Characteristics of the Respondents (n=83)

Variable	Frequency	Percentage
Educational level		
No formal education	16	19.3
Primary education	28	33.7
Secondary education	36	43.4
Tertiary education	3	3.6
Farming experience (years)		
1-5	9	10.8

6-10	20	24.1
11-15	14	16.9
16-20	14	16.9
21-25	10	12.0
? 26	16	19.3
Mean = 17		
Max. = 40		
Min. = 2		
Source of labour		
Family	8	9.6
Hired	42	50.6
Family and hired	33	39.8
Source of capital		
Personal savings	54	65.1
Borrowed from friends/relatives	23	27.7
Loan from microfinance bank	4	4.8
Loan from bank of Agriculture	2	2.4
Farm size (ha)		
? 0.5	63	75.9
0.6-1.0	15	18.1
> 1.0	5	6.0
Mean = 0.5		
Max. = 3		
Min. = 0.1		
Contact with extension agent		
Yes	55	66.3
No	28	33.7

Source: Field survey, 2023.

Majority (75.9%) of the respondents have farm size of ?0.5 hectares, 18.1% have farm 0.6-1 hectares and 6% have farm size >1 hectares (Table 3). The average farm size is 0.5 hectare; the maximum farm size is 3 hectares while minimum farm size is 0.1 hectares. This implies that the study area comprises mostly small-scale farmers. This agrees with Olayide (1992) that Nigerian farmers are small-scale farmers that cultivated small areas of land. The result on contact with extension agents revealed that most (66.3%) of the respondents had contact with Agricultural Extension Agents while, 33.7% of them had no contact with extension agents. This implies that majority of the respondents who claimed to have contact with extension agents have high chances of improving their productivity. This is in agreement with findings of Adejoh (2009), Ojoet al.(2009) and Ebonget al. (2009) and Oladeebo (2006) who observes that contact with extension agent exposes farmers to new technologies and improved varieties of inputs including seed.

Gross Margin Analysis of Irrigated Rice Farmers in the Study Area

The cost and return of irrigated rice production were estimated using the gross margin analysis as shown in Table 4 above. The result shows that the average variable cost per hectare was N470, 197.81 and the total revenue per hectare was N646, 235.66. The gross margin per hectare was N176, 037.85. It can be deduced

from the results in Table 4 that the respondents operated at profit level. As it can be seen, the return for every Naira invested was N1.37K. Thus, this finding indicated that engaging in irrigated rice production in the study area is profitable.

Table 4: Gross Margin Analysis of Respondents

Variable inputs	Value N/ha	Percentage
A: Variable cost		
Seed	22,874.02	4.87
Labour	296,568.75	63.07
Agrochemicals	24,177.37	5.14
Fertilizer	79,075.26	16.82
Packaging	20,002.41	4.25
Cost of hiring land\water	27,500.00	5.85
TVC/ha		
B: Returns	470,197.81	100
Total revenue per ha		
C: Gross Margin	646,235.66	
Gross margin/ha (TR-TVC)	176,037.85	
Operation Ratio (OR) TC/TR	0.73	
Return on capital invested (RCI) TR/TC	1.37	

Source: Field survey, 2020.

Problems Faced by Irrigated Rice Farmers in the study area

The major constraints affecting irrigated rice production is presented in the Table 5 above. The result revealed that majority (15.04%) of the farmers indicated that poor access to loan is the major problem affecting their production, about 14.58% also reported that low market prices is their major problem. About 13.89% reported limited farm size to produce. Good number indicated that grazing by animals is their major problem while 9.72% reported bad road network as their major constraint. This is in line with Vimtim and Ngwamdai (2017) in their study which Analyzed the Economics of Rain fed Rice Production in Mubi North Local Government area of Adamawa state, Nigeria who pointed out that the major constrains affecting rice production includes lack of credit facilities, land, poor pricing and high cost of transportation among others.

Table 5: Problems Faced by Irrigated Rice Farmers

Problems	Frequency*	Percentage
Poor access to loan	65	15.04
Low market prices	63	14.58
Limited farm size	60	13.89

Grazing by animal	54	12.50
Bad road network	42	9.72
High cost of fertilizer	37	8.56
High cost of labour	35	8.10
Pest and diseases	32	7.41
Poor access to extension service	28	6.48
Lack of improved hybrid seeds	11	2.55
Theft	5	1.16

Source: field survey, 2020. Multiple responses*

CONCLUSION AND RECOMMENDATION

Rice production in the study area was dominated by men, who were married, small scale farmers cultivating an average of 0.5 hectares of land. Most of the respondents have access to formal education and extension service while little of them had access to credit. From the result of the gross margin it can be concluded that rice production is profitable with return on Naira invested of N1.37k in the study area in spite of the numerous challenges confronting the farmers.

Based on the findings of the study, the following recommendations were proffered;

1. Government and non-governmental organization or stakeholders in the agricultural sector should ease the farmer's access to farm credit through low or zero interest rate policy and loan guarantee scheme, so as to make access to loan easy and that they can expand production, which will invariably raise their productivity and generate more jobs to our teeming unemployed youths.
2. Government should reinstate the agricultural price policy such that agricultural imports do not enjoy undesirable comparative advantage over local commodities and also agricultural commodity prices be in parity with those of non-agricultural commodities in order to overcome the problem of low market price.
3. Farmers are encouraged to form cooperative association so that they can interact with each other on problems of mutual interest, and also benefit incentives such as loan put forward through government programs and political parties.
4. Government should expand the irrigation projects nationwide in order to increase production potentials and overcome the problem of limited farm size.
5. Grazing area and ranches should be provided to herders and also fence the irrigation area to prevent miscue of animals during grazing and enable the farmers to reap the benefit of their effort.
6. Good roads should be constructed to enhance input distribution and the evacuation of farm produce.
7. Subsidy policy should be reinstated on inputs especially fertilizers, hybrid seeds and other agrochemicals through the use of national identity card project to reach all the targeted farmers.

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