



Economics of Rice Production Under the Hadejia-Jama'are River Valley Project, Jigawa State, Nigeria

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Abstract

The study was carried out in Auyo Local Government Area of Jigawa State, Nigeria to assess the economics of rice production under the Hadejia Jama'are river valley project. The specific objectives of the study were among others is to; describe the socio-economic characteristics of rice farmers in the study area, assess the efficiency of input utilization in the study area, and determine the profitability of rice production in the area. Simple random sampling was used to select 120 respondents who were interviewed using structured questionnaire by trained enumerators. The analytical tools employed include descriptive statistics, multiple regression and net farm income. The results from socio-economic characteristics showed that majority (32.5%) of the respondents fall within the age range of 31-40 years with 75% of them married and having a family size ranging between 0-5 people. Results from the profitability analysis indicated that a total of N9,619,450 was realized as the profit from rice production in the study area. The multiple regression results showed 67.4% of the variation in the dependent variable (total yield) is explained by the independent variable included in the model. The results also revealed that farm size, labor and fertilizer used had negative and significant relationship with output. Results from resource use efficiency imply that the variables of interest were seed, fertilizer, hired and family labor. From the results, seed has Marginal Value Product (MVP) of N4098.4 and Marginal Factor cost (MFC) of N100 per kg which is less than MVP, thus a ratio greater than 1. Hired labour has MVP of N2245.7 and MFC of N86.43 which is less than MVP; this implies that seed and hired labor were underutilized in rice production. Pest and diseases was the major problem facing the farmers in the study area. The study concluded that rice production is highly profitable in the study area. It was recommended that such projects should be replicated in many parts of the state to boost and increase rice production.

Keywords: Economics, Rice Production, Hadejia-Jammare River Valley, Project

1.0 Introduction

Rice (*Oryza Sativa* L) ranks third after wheat and maize in total cereal production, in 1999 alone, the demand for rice was 2.31 million metric tons while the supply was 1.38 million tons (F.A.O, 2001). Globally, rice production has also witnessed increased trend, in 1980, about 280 million tons of rice were produced from 245 million hectares all over the world (F.A.O, 2011). However, in 1993, 518 million metric tons of rice was produced from 148 million hectares of land (F.A.O, 1994). The average yield per hectare from 1979-1981 in Nigeria was 1.98 tons while in 1993, it was 1.94 tons and in 1995 2.0 tons (Aliyu, 2008). The establishment of "Hadejia River Basin Development Authority" in 1976 with headquarter at Kadawa town in Kano State, has its main objectives for the development of agricultural products (Ahmed and 2004). Its establishment coincided with a break through by the Kano State Government in the development of agriculture in the state. The initiation was made immediately after the experience of 1973 draught which affected the production of many food and cash crops



Hodder,1973). As many farmers in the state are dependent on the groundnut, which was an export crop, the draught adversely affected their income and living standard when the state government gave priority to agriculture; Tiga Dam was constructed to allow farming activities during the dry season. The dam was a Joint Venture between the state government, and the World Bank (Alkasun, 2015). It was a gigantic programme. When the dam was completed, it was expected to create reservoir with a capacity for storing some 4 million gallons of water to a projected 180,000 acres of land (N.A.S.R, 2010). Among the purpose which the dam was to serve include the development of irrigation; this task was taken up by the ministry of agriculture. Since the establishment of Hadejia – Jama’are River Basin Development Authority, it has been facing many problems ranging from lack of adequate financing to execute its programmes to lack of qualified personnel and the problems of communication between the officials of the River Basin and the farmers (Iliyasu, 2008).

Rice which was previously grown under rain fed conditions is now widely grown under irrigated conditions (Grist, 2015). However, the demand for rice has been higher than the domestic supply of the crop (Fulani, 2010). This research considers the economic production of rice to provide useful information, which may be processed into solution for the problems noted in the study area by providing answer to the following questions. What are the socio-economic characteristics of the farmers? What is the profitability of rice production in the area? What is the resources utilization by farmers in the area? What are problems associated with rice production in the area? Do farmers in the areas enjoy loan and other facilities from the government?

The general objective of this study was to determine the economics of rice production under Hadejia Jama’are River Valley Project while the specific objectives were to describe the socio-economic characteristics of the respondents in the study area, determine the profitability of rice production in the area, assess the efficiency of input utilization in the study area and to identify the problems faced by farmers in the study area.

Production function is used to assess resource use efficiency in rice production, three models (Linear, Cobb-Douglass, and Semi – log were tried), but based on statistical and econometric considerations, the linear function was selected as the best on the basis of R^2 , the T and F – values as well as the sign of the estimated parameters (Heady and Dillion 2009).

2.0 Methodology

The study was conducted in Jigawa state. The state lies between latitude 11.00° E and 13.00° north of the equator and longitude 8.00° E and 10.15° east of the Greenwich Meridian, and covers a land area of 24,410 square kilometers and its located in north western part of Nigeria. It shares boundary with Yobe, Kano and Bauchi states (JARDA, 2008). Auyo Local Government has a population of 97,000 and rice cultivation is the predominant occupation among the people. The land form is generally undulating, giving way to “Jigawa” topography. “Jigawa” is a Hausa word referring to vast loamy and non-marshy soil favorable for the cultivation of crops like groundnut, millet, Guinea Corn, Cassava, Rice, and Wheat (Ahmed, 2007). Jigawa State has arduous climate with relatively wide and rapid changes to temperature and humidity, at times rise up to 100%. At this period, the temperature can fall to as low as to 10° C. (Francis, 2018). The study is an exploratory study of the economics of rice production under the Hadejia – Jama’are River Valley Project, and the survey method was used for gathering information. The individual farmers are the units of analysis in this study. The samples size comprises of one hundred and twenty (120) farmers selected from Yamidi 30, Gatafa 30, Ganuwar – Kuka 30, Kubayau 30. All questionnaires were duly filled and returned. Data were collected from primary sources on inputs, labour, capital sources, yield, and problem associated with the production process. The Data collection procedures involved purposive sampling of the respondents and then interviewing them with self-administered questionnaires.

3.0 Data analysis

Statistical package for social scientist (SPSS) was used to analyse the data. The analytical techniques employed for this study include both descriptive and inferential statistics. Descriptive statistics in form of frequency, percentages, means, minimum, maximum, standard deviation and standard error was used to describe the socio-economic characteristics of the respondents and the constraints faced by the farmers in the study area. The



inferential statistical tool used was net farm income, resource use efficiency and multiple regression respectively. Net farm income was used to determine the profitability of rice production and gross income realized from the production. The net farm income is defined as the difference between the gross margin (GM) and total fixed cost (TFC) (Omotesho and Oladeji,2003). In calculating net farm income, fixed costs (FC) are considered because output vary with fixed inputs such as land, hoe, cutlass and sickle/knife cutlass. (Fulani, 2010).

1.2.1 The specification of the models

The net income is defined as the difference between the gross margin and the total fixed cost.

$$NFI = GM - TFC$$

Where NFI = Net Farm Income

GM = Gross Margin

TFC = Total Fixed Cost.

1.2.2 Profitability of the enterprise

This subsection deals with the examination of the profitability of rice production. It involves both gross margin as well as net farm income. The former is the difference between gross income and total variable cost, while the latter is the difference between gross margin and total fixed cost. Thus, the only difference, between the two mentioned above is the fixed cost.

GM = GI-TVC where

GM = Gross Margin, GI = Gross Income

TVC = Total Variable Cost

NFI = GM-TFC where

NFI = Net Farm Income

GM = Gross Margin

Resource use efficiency was defined as the quantity of output per unit used in the production process (Olukosi and Erhabo, 2018). It is also determined by using the MVP (marginal value product) and it's MFC (marginal factor cost). A ratio less than unity shows over utilization of that resources and profit would be increased by decreasing the quantity of that input used. A ratio greater than unity indicates underutilization of the input and increasing the rate of use of that input will increase the level of profit of the firm. The MFC of fertilizer and seeds were taken at their respective market price while for both family and hired labour, the geometric mean of the costs were taken for a linear function, the M.V.P with respect to each of the variable input was determined through the following formula.

MVP = $\frac{Py}{b_i}$ where

MVP = Marginal value product

bibi = Marginal physical product

Note: Py (output price) was computed by using various prices level of the respondents.

4.0 Results and Discussion

4.1 Socio-economic characteristics of the respondents

The socio economic characteristics of the respondents usually assist in getting a clear understanding of their behavior as well as providing a hint towards explaining their disposition that could improve their productivity



Adebayo and Akinwade, (2012). The socio economic characteristics of the respondents considered in this study include; Age, Marital status, house hold size, educational qualification, gender, major occupation, membership of cooperative, income level of the respondent, farming experience, farm size, and contact with extension agents.

Table 1: Socio economic Characteristics of the Respondents

Variable	Frequency	Percentage (%)
Age(years)		
20-30	27	22.5
31-40	39	32.5
41-50	28	23.3
51-60	26	21.7
61-70		
Marital Status		
Single	30	25
Married	90	75
Household Size (no)		
0-5	33	27.5
6-10	24	20
11-15	23	19.1
16-20	21	17.5
21-25	11	19.1
26-30		
Educational Qualification		
Primary	35	29.2
Secondary	25	20.8
Tertiary	10	8.4
Quranic	50	41.6
Major occupation		
Fishing	23	19.2
Tailoring	29	24.2
Animal rearing	30	25
Trading	26	21.6
Hunting	12	10
Seed Variety used		
Improved	35	29.2
Local	55	45.8
Both	30	25
Source of seed		
Personal	23	19.1
Market	42	35.1
Seed farmers	43	35.8
Government	12	10
Source of labor		
Family	83	69.2
Hired	22	18.3
Both	15	12.5
Source of fund		
Personal savings	75	62
Friends/relatives	25	20.8
Money lenders	15	12.5
Bank loan	5	4.7
TOTAL	120	100

Source: Field survey, 2002



Age plays a fundamental role in agricultural production activities. Thus, it influences behavioral change as well as decision making in production (Bor, 2011). The table 1 shows that 22.5% of the respondents have their age falling within the range of 20-30, 32.5% fall within 31-40, and 23.3% fall within 41-50. While the remaining 21.7% fall within the range of 51-60. This means, the majority of farmers, in the study area have their age falling within 31-40 years. Marital status is also a key factor that make farmer to work hard, so as to produce enough both for him as well as for the entire family. Table 1 reveals that 75% of the respondents were married, while 25% were single. This means that majority of farmers were married, capable of decision making. This agrees with the findings of Babaji and Singh, 2017 in a study conducted in Gombe on rice farmers who posited that married people have more tendencies to make meaningful decisions.

Family size is also determinant factor towards improving/increasing the productivity of farmers. It is the immediate asset available, because most peasant farmers rely solely on family labour for their farming activities. Table 1 shows that 33% of the respondents have family size within 0 – 5, 24% have 6-10, 23% have their own between 11-15 and 21% of them have their family size ranges from 11-15 respectively. This means, most of the farmers have their family size ranges from 0.5 respectively. Etuk and Abalu, (2009) agreed that family size is key in most rural farm families to bring an increase in yield and its income. Education is the backbone for any development in any setting or activity, thus, education plays an important role in agricultural production. Farmers that are educated are likely to obtain higher yield than those who are not, because the former can easily adopt innovation than the latter. Table 1 show that 29.2% of the respondents have primary education, 20.8% had secondary education while 8.4% and 41.6% had tertiary and Quranic education respectively. This entails that majority of the farmers had Quranic education. This result disagrees with that of Komolafe *et al.*, (2015) in a study of farmers awareness on the use of improved maize variety that majority of the farmers in the study area had tertiary level of education.

The table 1 also reveals that 42.5% of the respondent spent 11-15 years in education, 20% spent from 5-10 years, while the remaining 7.5% spent the following ranges: 0-5, 16-20, 21-25, 26-30, above 30 age respectively. This means, majority of farmers spent from 1-15 years at school. Occupation refers to the type of activities either major or minor, done by the farmers. Both of them help the latter to earn profit there by solving his basic needs. The study shows that all the farmers investigated were into farming as their major occupation, while the table 1 shows 19.2% had fishing as their minor occupation, 24.2% were engaged in tailoring as their minor occupation, 25% reported animal rearing, the remaining 21.6% and 10% reported training and hunting as their minor occupation respectively. This means that, most of the respondents engaged in fishing as their minor occupation followed by trading and tailoring. This is in agreement with the findings of Kanoma, 2011 who revealed that farmers in most rural farming communities rely on other means of livelihood to support themselves. Under normal circumstances, farm must have positive relationship with the output of the farmers, in other words, increase in farm size leads to increase in output. Table 1 reveals that 45% of the farmers hold farm size falling within 0.5, 15% possessed their own above 30, 12.5% and 12.5% owns falling within 6.10 and 11-15 respectively, while the remaining farmers have their own farm size falling within 16-20, 21-25 with 5% and 7.5% respectively. This means that most of the respondent's farm size falls within the range of 0.5 (ha). This result is in line with Liade, (2018) who discovered that the larger the farmers farm size the higher the output.

Table 1, reveals that 75% of the farmers used improved variety, while 2.5%, 75% use local variety and the farmers use improved variety, while 2.5%, 75% use local variety and the combination of the two respectively. Makarfi (2005) in a study on economic of Wheat Production, under surface irrigation: A case study of Kano River Project Phase 1 discovered that majority (99%) project farmers use improved seed for production. Table 1 shows 52.27% of the farmers acquired their seeds from personal saving, 36.36% from friends, while the remaining 11.37% acquired their seeds from government. This implies that, most of the farmer's source seeds from personal saving followed by donation from friends.



The table 1 above reveals that 19.1% of the respondents sourced their finance from previous harvest 6.66% from credit, while 11.12% sourced from both credit and previous harvest. This means that most of the farmers sourced their finance from previous harvesting. Furthermore, table 1 shows that 53.65% of the farmers were using family labour, 41.46% hired labour, while the remaining 4.89% were using both family and hired labour. This means family labour is the most abundant form of labour followed by hired labour.

4.1.1 Profitability of the enterprise

This subsection deals with the examination of the profitability of rice production. It involves both gross margin as well as net farm income. Mayaki, Mauya and Kumar (2009) in a study on Crop Rotation Under Irrigation at Kaduna State define profitability as The former is the difference between gross income and total variable cost, while the latter is the difference between gross margin and total fixed cost. Thus, the only difference, between the two mentioned above is the fixed cost. The total variable cost which include cost of labour, fertilizer, seeds, agro chemical cost were computed to be N115,821,450-N191,174=N115,630,276.

Similarly, total fixed cost that included cost of transportation, cost of machineries hired, and animal traction cost, was computed to be N50950. The net farm income was obtained through the following equation.

$$\begin{aligned}
 \text{NFI} &= \text{GM} - \text{TFC} \\
 &= \text{N}9670400 - \text{N}50950 \\
 &= \text{N}9619450.
 \end{aligned}$$

Gross margin, net farm income with respective value of N9670400 and N9619450 were found to be profitable. Consequently, the rice production in the study area is profitable. Moreover, the total cost, therefore can be assumed as negligible.

4.1.2 Gross Income, Net Farm Income and Gross Margin

A. Gross income

This is also referred total revenue; it is equal to total physical production multiplied by the price (output). Table 2 reveals that 40% of the farmers generated gross income above, within N60,000, 20% generated income falling within, the range of N5000 N10,000, 10% generated income ranging from N10,001 – N20,000, 5% generated their own from 40,001 – N50,000 while 7.5%, and 2.5% generated income falling within the range of 30, 001 – N40,000, N50,001 – N60,000, less than N5000 and N20,001 – 30,000 respectively. This means majority of farmers generated income above N60, 000 followed by those fall within 5000 – 10,000.

Table 2: Distribution of respondents, according to their gross income/ha.

Seeds source	Frequency	Percentage
Less 5000	10	7.5
50000 – 10,000	8	20
10,001 – 20,000	4	10
20, 001 – 30,000	1	2.5
30,001 – 40,000	3	7.5
40,001 – 50,000	2	5
50,000 – 60,000	3	7.5
Above 60,000	16	40
Total	120	100

Source: Field survey, 2002

Table 3 below showed that 42.5% of the respondent have generated gross margin less than N60,000, 27.5% above 50,000, 10% within the range of 60,001 – 10,000 while 7.5% generated gross margin falling within N10,001 – N20,000 and N30,001 – N40, 000 respectively. The remaining 2.5% and 2.5% generated gross margin falling



within N20,001 – N30,000 and N40,001 – N50,000 respectively. This implies majority of the farmers in the study area generated gross margin less than N600 followed by those that generated above N50,000. this agrees with Obinne, (2007) findings on the gross income of palm oil marketers in ondo state that farmers get less income on the farming activities due to the low capital invested on it.

Table 3: Distribution of farmers according to their gross margin.

Seed Source	Frequency	Percentage
Less 6000	17	42.5
6001 – 10,000	4	10
10,001 – 20,000	3	7.5
20, 001 – 20,000	1	2.5
30,001 – 40,000	3	7.5
40,001 – 50,000	1	2.5
Above 60,000	11	27.5

Source: Field survey, 2002

Table 4 below revealed that 45% of the respondents earned net farm income less than N7000, 30% earned above N50,000 while the remaining 7.5%, 7.5%, 5%, 5% earned their farm income falling within N7001 – N20,000, N30,001 – N40,000, N20,001 – 30,000 and N40,000 – N50,000 respectively. This disagrees with Olatunbosum, (2014) in a study conducted on the marketing conference consortium for the study of Nigeria’s Rural Development (O.S.N.R.N) that farmers faced mostly with less net farm income.

Table 4: Distribution of farmers, according to their net farm income.

Seeds source	Frequency	Percentage
Less 5000	18	45
7001- 20,000	3	7.5
30,001 – 30,000	2	5
30, 001 – 40,000	3	7.5
40,001 – 50,000	2	5
Above 50,000	12	30
Total	40	100

Source: Field survey, 2002.

4.1.3 Production Function

Table 5 below shows the estimated coefficient with result to independent variable as well as their corresponding T – values. It also shows the coefficient of multiple determinations R^2 to be 0.674; this implies that about 67.4% of the variation in the dependent variable (total yield) is explained by the independent variable included in the model. The table reveals that, with respect to the coefficient and T – values, farm size indicates a negative and insignificant relationship with the output, this means that increase in one unit of farms size by 1 hectare holding the other factors constant would lead to 27.964 unit decreases in the output. With respect to seed used, the table 5 also reveals that there is a positive and significant relationship at 1% level between seed and output, so a unit increase in the quantity of seed used will increase output by 40.984 units. The table 5 also reveals that there is a negative and significant relationship at 1% level between family labour and the output; this indicated that a decrease in the family labour will lead to an increase in the output. With respect to fertilizer used, table 5 reveals that there is a negative and insignificant relationship between fertilizer and output; this means that a unit decrease in the quantity of fertilizer used will lead to an increase in the output. With respect to hired labour, the table reveals that there is a positive and significant relationship at 1% level between hired labour and the output; this means that a unit increase in the hired labour will increase output. The variability regarding input utilization is explained by R^2 . This result agrees with Ojo, (2012) who reported a high R^2 value on estimated linear production result for cassava farmers in imo state.

4.1.4 RESOURCES USE EFFICIENCY

TABLE 5: The estimate linear production result.

Independent variable	Estimated Coefficient	T – Ratio
(Constant)	-1553.10	- 210
Plot size (ha)	-278.964	- 505
Seeds (kg)	40.984	4.962**
Family labour	-46.083	- 5.962**
Fertilizer	-3.158	- 1.430
Hired labour	25.983	3.654**

R ²	=	0.674, F – value	14.028**
N	=	40	
DF	=	34	
NS	=	Not significant	
*	=	Significant at 5% level.	
**	=	Significant at 1% level	

Source: Field survey, 2002.

Table 6 below shows the MVP, MFC and MVP/MFC ratio with respect to some of the independent variable. Seed has MVP of N4098.4 and MFC of N100 per kg which is less than MVP, thus a ratio greater than 1. Hired labour has MVP of N2245.7 and MFC of N86.43 which is less than MVP; this implies that seed and hired labour were under utilized in rice production.

Table 6: MVP, MFC and MVP/MFC

Variable input (N)	MVP	MFC	MVP/MFC
Seed (kg)	4098.4	100	40.984
Hired labour	2245.7	86.43	25.98

Source: Field survey, 2002

Problems encountered in the production process and suggestion

Table 7 shows that 41.95% of the respondents have reported pest and disease as problem 3.22% reported poor road, while 19.36%, 9.67%, 6.45%, 1.62% and 4.83% reported flooding, lack of fertilizer, land degradation, low price and lack of capital as problems respectively. This implies that majority of farmers were facing problem of pest and disease and followed by flooding.

Table 7: Distribution of farmers, according to their net farm income

Problems	Frequency	Percentage
Pest and disease	26	41.94
Poor road	2	3.22
Flooding	12	19.36
Lack of fertilizer	6	9.67
Land degradation	4	6.45
Low price	1	1.62
Lack of capital	3	4.83
Poor drainage	7	11.24
Lack of farm machinery	1	1.62
Total	62	100

Source: Field survey, 2002



5. Summary and Conclusion

The study starts by describing the socio-economic characteristics of sampled farmers in the area. This cut across farmer's age, sex, family size, as well as educational background, as these effects production capacity of farmers. The study also reveals that only 15 farmers acquired Western education out of 40 sampled with majority having Qur'anic education. These of course have effect towards accepting and adopting new technology. Majority of the farmers, employed family labour i.e. 22 farmers used family labour out of 40 farmers sampled while 17 farmers out of 40 farmers employed used hired labour, and only 3 farmers out of 40 used combined labour i.e. family and hired labour, for the farming operations. Most of the farmers finance their farm operations from their personal savings, i.e. 3 farmers output 40 sampled used their personal savings and only 3 farmers obtained loan from external sources i.e. government, while 4 farmers received loan from bank sources, and only 2 farmers obtained loan from bank as well as from their personal savings, only 2 farmers out of 40 farmers obtained loan from government and bank. Descriptive statistics was used to determine the socio-economic characteristics of the farmers, resources and their utilization by the sampled farmers. Gross – margin analysis of rice production was used to determine the profitability of rice production in the area, in which case, it indicated that gross margin, net farm income with respective value of N9670400 and N9619450 were found to be profitable. Consequently, the rice production in the study area is profitable despite the incidence of pest and disease, flooding, poor drainage. In determining the resource use efficiency by the farmers, linear regression was used.

The findings from the study have no doubt helped in achieving the objectives of the study. The study reveals that rice production under Hadejia-Jama'are Valley Project is profitable. However, the study identified some problems militating against irrigated rice production in study area such as overflow, poor drainage, poor road, which reduces capacity utilization of the farmers and efficiency of production.

6. Recommendation

The findings from the research study should be made available to the appropriate authority for consideration. The state government through the ministry of agriculture in conjunction with agricultural parastatals (Jigawa State Agriculture and Rural Development Authority), Agricultural and Co-operative Bank (N.A.C.B), and commercial banks should provide necessary financial assistance in form of interest free loan to the farmers in the area to rise their incomes, investment and standard of living which will result in to high production. The government should revisit the issue of subsidy removal with the aim of restoring it in order to boost agricultural production and rice production in particular. There is the need for the establishment of organized marketing and distribution system of rice commodity to control price fluctuation which many have a negative impact on the producers as middle men always buy from them at a cheaper rate and sell it to consumers at exorbitant prices. Government, through extension agents should mobilize and create awareness among the farmers on the potentials of rice production and its prospects. This will aid in large scale production of the commodity (rice). However, extension agents should be employed at the study areas to educate farmers on the importance and need to accept and adopt new ideas or technology. The Government should provide more irrigation facilities such as irrigation pumps, in order to facilitate rice production in the study area. On the occasional flooding in the area, farmers should make terracing and hedges round their farms with adequate drainage system to provide good water out-let from the farms. Government should also assist them to plan ahead and accruing of the river and Dams more deeply and wider to reduce incidence of over flowing. Bird's damage to rice could be controlled by occasional shouting in the farms by children, or empty tins beating in the farm as well as shootings, chemical such as pesticide, insecticide also should be applied at the recommended doze and at appropriate time for the control of pests, disease, and weeds. However, farmers in the study area should not go for loan as it has no impact on their net farm income, i.e. whether the farmers enjoy loan or not, the production remains unchanged, and farmers can improve more in terms of production if the loan is interest free as the financial institutions receive more than the actual money given as loan to the farmers.



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