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RESOURCE-USE EFFICIENCY OF RICE PRODUCTION IN KURA LOCAL GOVERNMENT AREA OF KANO STATE, NIGERIA

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ABSTRACT

Rice is an important crop to the Nigerian economy. However, the level of inputs used in its production are not at the optimum level. This study examined the resource use efficiency of rice producers in Kura LGA of Kano State, Nigeria. Data used for the study was obtained by scheduled interview using structured questionnaires administered to 115 respondents selected using a simple random sampling procedure. Descriptive statistics, budgetary techniques and multiple regression were used to analyze the data. Results obtained revealed that the mean age of the farmers was 31 years, most of the farmers were male, educated and with farming experience of 8 years. Results for profitability of rice production showed that the net farm income for rice production was ₦176922.2 with a return to Naira investment value of 2.7. This implies that 1₦ invested on rice production would give a return of ₦1.7. Results for regression analysis showed that farm size, agrochemicals, and labour had a significant effect on output. Analysis of return to scale was 4.5. This indicates an increasing return to scale with increased use of input resources. Results for resource-use efficiency revealed that farm size, agrochemicals, seed quantity, and labour were under-utilized. Further analysis showed that inadequate capital and poor extension service delivery affected rice production. The study recommended improvement on extension service delivery. The government, Non-governmental organizations and farmer organizations were advised to educate the farmers on appropriate use of farm inputs and ensure the availability of these inputs to farmers at subsidized prices. Farmers could be provided with soft agricultural loans to finance purchase of equipment and production inputs.

Keywords: Efficient; Resource-use; Profitability; Rice-production; Kano-state.

INTRODUCTION

Background to the study

Cereal production, especially rice output in Africa, has been low over the past two decades despite the increase in the area cultivated. A study by Competitive Africa Rice Initiative (CARI) (2018) shows that rice cultivation in Africa is important given that, for the 27 million metric tonnes produced in 2018, West Africa alone cultivated about 66%. While Nigeria is identified as the biggest producer of rice in Africa, it is also the largest importer among the rice importers in West Africa (Biam & Adejo, 2017). Data from the Food and Agricultural Organization (FAO) database shows that for about 5,330,290 million tonnes of rice demanded in 2013, about 2,187,370 million tonnes were imported (FAOSTAT, 2012). Kamai, Omoigui, Kamara, & Ekeleme (2020) opined that rice consumption in Nigeria has grown rapidly over the past decade and is currently at an all-time high of 7 million metric tonnes. With only 2.7 million metric tonnes produced locally, the shortfall of 4.3 million metric tonnes needs to be imported.

The low productivity challenge of the Nigerian farmers could be linked to environmental factors and inadequate awareness of appropriate farm inputs, financial difficulties and lack of adequate improved technology (Ufiobor, 2017). In general, the attempt to increase rice production with a given quantity of input resources had been studied under the neoclassical theory of production (Yusuf, 2016). It is observed that optimum production levels are attained by an upward shift of output to the production frontier when each factor yields at optimum productivity. Attempts at upward shifts of the production frontier could be the *raison d'etre* of the green revolution and the Nigerian government's various agricultural projects and programs (Oluwatoyin, 2014). Iwuchukwu & Igbokwe (2012) opined that success in the use of technological approach to improve agricultural production needs a level of research and extension services which increases costs and involves a lot of time. However, an upward shift in the production frontier can be attained by adjusting resource allocation. This approach may be cheaper, takes a short time, and give higher levels of production. The approach of increasing agricultural output by efficient use of resources may be important especially for rice production given the high demand for the crop in Nigeria as well as in other parts of developing countries. Analysis of resource-use efficiency in agriculture is particularly important in achieving the overall development goal of the rural economy.

The importance of increased rice productivity lies in the fact that it assists in determining the supply of food as well as playing an important role in contributing to the economic importance for developing countries. According to Sakurai, Furuya, & Futakuchi (2006), rice production is the source of livelihood and contribute to economic development of developing countries. Rice production (despite its importance, however) requires various combinations of inputs for improved output. The level of rice productivity depends on the quantity, frequency, combination, and timely application of the different inputs required for its production. Efficient use of any input resource depends not only on quantity but has to do with the price of such input. As such, resource-use efficiency is when a low quantity of inputs (possible at low costs) are used to give maximum output possible. Thus, efficient use of input combination is considered to have been achieved with the lowest possible input combination at the lowest possible cost. For most farmers in developing countries, there is little capacity directed towards raising output by increasing the production of inputs. Given the demand and supply gap of rice in addition to population growth in Nigeria, there is an increased importation of rice to reduce the demand-supply gap. However, to uphold the Nigerian government's policy of encouraging domestic rice production to meet up with the shortfall, the likely challenge in rice production could be the inefficient use of resources that results to low rice yield in the country. The main objective of this study is to examine the resource-use efficiency of rice farmers in Kura LGA of Kano state. Specifically, the study seeks to: determine the cost and benefit from rice production, examine the efficiency of resources used by rice farmers and identify the major problems faced by producers. The results of the study will provide the information needed by the farmers, policymakers and rice production operators to maintain an optimum supply of the crop to meet up with the demand

MATERIAL AND METHODS

This study was conducted in Kura Local Government Area (LGA) of Kano State. The study area is located at 11^0 46` 17" N and $8^0$ 25` 49" E. Its population in 2006 was about 14,601 (NPC, 2006) and with a growth rate of 2.6%, it estimated that by the year 2021, the estimated population was 21416.86. Kura is known for foodstuffs and vegetable crops production. The dry season mostly starts from October to April with an average annual rainfall of 134.4mm (Osang, Ewona, Obi, Udoimuk & Kamgba, 2013). The major occupation in Kura is farming with rice, wheat, maize, millet, beans, tomatoes, sugarcane, and cabbage as major crops produced. Some of the farmers in the study area are producers, processors, and marketers of both paddy rice and milled local rice in the state.

Sampling techniques

Kura LGA is located in Zone 1 of the state agricultural zone and has 5 agricultural sectors (New Dalili, New Agolas, New Kosawa, New Tsauni, and Kore Night). These agricultural districts are made up of 28 rice producing villages. A two-stage sampling procedure was adopted in selecting the respondents to be interviewed for the study. Three agricultural sectors (New Dalili, New Agolas, New Kosawa) were purposively selected from the 5 agricultural sectors to solicit data for the study. From each agricultural sector, two villages were purposively selected. The simple random sampling method was used to randomly select respondents from the selected villages (Table 1). Selection of sample size was done following the work of Yamane (1967) as shown in equation (i).

$$n = \frac{N}{1+N(e)^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(i)}$$

Where, n = Sample size required, N = Sample population, D = margin of error.

The reason for selecting a sample to work with was to get a representative sample that can be generalized for the entire LGA. A total of 117 respondents were selected and issued with questionnaires for the study. However, 115 were returned and used for the analysis while 3 were not completely filled (and were rejected).

Table 1: Sample size selection in Kura LGA of Kano state

Agricultural Sectors	Selected villages	Population of Rice farmers	Number of selected farmers
New Dalili	Karfi	30	21
	Gori	27	20
New Agola	Angolas	25	18
	Goro	21	15
New Kosawa	Kosawa	28	20
	Yakasai	32	23
Total	**6**	**163**	**117**

Source: Field survey, 2022

Method of data collection

The study made use of primary data collected during the 2020/2021 rice cropping season. Using trained facilitators, data collected include; socio-economic characteristics of rice farmers, farm production information to include farm size, labor, fertilizer, the quantity of herbicide/pesticide used, rice output of the rice farmers, and market information which includes market prices of harvested rice output and inputs used. Secondary data used was obtained from Kano State ministry of agriculture, the Kano State website, and the National Bureau of Statistics.

Analytical Techniques

Descriptive statistics, such as mean and frequency distribution were used to analyze the socio-economic characteristics of the respondents. Other analytical tools used were the budgetary techniques and Ordinary Least Square regression. The data were first subjected to statistical tests to establish its normality in distribution. This was done by comparing the p-value of the Shapiro-Wilk Test at 0.05% level. When the results of the test values are greater than 0.05 statistical level, it shows that the data is normally distributed. Data value below 0.05 shows a significant deviation from normal distribution (Laerd Statistics, 2012; Muhammad-Lawal, Memudu, Ayanlere, Mohammed, & Olajogun, 2013). To test for the homogeneity of variance or the presence of heteroscedasticity and autocorrelation, the Levene's test and Durbin-Watson statistics were employed following the approach of Gujarati (20003).

Gross Margin Analysis

The gross margin analysis was used to analyze the cost and profitability of rice production in the study area. The works adopted the approach of Nimoh, Tham-Agyekum & Nyarko (2012) as shown in equations (ii) and (iii) as;

$GM_i = GI_i - TVC_i$ ……………………………………………………… …………… (ii)

and $NFI_I = GM_I - TFC_I$ …………………………………………………......... ..... (iii)

Where; GM is gross margin measured in Naira, GI is gross income (Naira), TVC is the total variable cost (Naira), TFC is total fixed cost (Naira), NFI is the net farm income/profit (Naira) and the return on investment (ROI) is the gain from investment minus the cost of investment divided by the cost of investment.

Regression Analysis

Multiple regression was used to estimate the elasticity of production and returns to scale using the ordinary least squares method. The implicit form of the model was specified by equation (iii) as:

$Q = f(X_1, X_2, X_3, X_4, U_i)$ ……………...…………..…………………………..… ……... (iii)

It is expected in *a priori* that all independent variables (X_i) have positive relationships with output. The following functional forms of the explicit production functions were fitted to the data. The different functional forms are described from equations (iv) to (vii) as:

Linear Function

$Q = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_5 + \beta_4 X_4 + U_i$………… ……...……………….…………........(iv)

Cobb-Douglas Function

$logQ = \alpha + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + U_i$ ………………..……..……. (v)

Semi-log Functions

$Q = \alpha + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + U_i$ ……………………..……..………(vi)

Exponential Functions

$\text{Log } Q = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_5 + \beta_4 X_4 + U_i$ ………………..……..……………....…(vii)

Where; Q = Quantity of rice output (Kg), X_1 = Farm size (Ha), X_2 = Agrochemicals (Liters), X_3 = Seed quantity (Kg), X_4 = Labour (man-hours), α = constant, β = Regression coefficients, U_i = Stochastic error term. The study adopted the work of Olayide and Heady (1982) to determine the equation of best fit. The equation was chosen based on economic, econometric, and statistical criteria: the magnitude of the coefficient of multiple determination (R^2), the significance of the individual explanatory variables (as expressed by their *t*-values), the significance of the overall production function (as determined by the *F* – value), and the appropriateness of the signs of the regression coefficients based on *a priori* expectations.

Input Elasticity (Ep) of the Various functional Forms.

The elasticity for the different functional forms cab be estimated using the different equations as shown by (viii) to (xi).

$$Double\log : Ep = bi \quad \text{…………………………….(viii)}$$

$$Linear : E\ p = \frac{dQ}{dXi} * \frac{Xi}{Q} = bi * \frac{Xi}{Q} \quad \text{…..………(ix)}$$

$$Semi\log : Ep = \frac{dQ}{dXi} * \frac{Xi}{Q} = bi * Xi \quad \text{…………….(x)}$$

$$Exponential : Ep = \frac{dQ}{dXi} * \frac{Xi}{Q} = \frac{bi}{Q} \quad \text{……...……(xi)}$$

Where; Ep = elasticity of production, b_i = regression coefficients, Q = geometric mean of output, X_i = input use of i^{th} resource;

$\delta Q / \delta X$ = derivative of Q to X_i; PX_i = price per unit of ith resource; PQ = Price per unit of output; and MFC = marginal factor cost;

To determine the resource-use efficiency of rice farmers, this study adopted the approach of Tchokote, Nguezet, & Onyebuchi (2015) where the marginal value product (MVP), the additional output received from using an additional unit of input resource for each resource, was computed and compared with the respective acquisition cost (MFC). The MVP of a particular resource was computed using the following equation (xiii to (xvii) as follows.

$MVP = MPP\ X_i$ ………………………………… (xiii)

Where:

MPP X_i = the marginal physical product of X_i resource that was used in the production process.

Depending on the function form chosen as the lead equation for the study, the MPP and the MVP can be estimated with the following equations.

Linear;
$MP = \frac{\partial Q}{\partial X} = b_i \ and \ MVP = b_i X_i P$ …………….. (xii)
Double-log;
$MPP = b_i * \frac{Q}{X_i} \ and \ MVP = b_i * \frac{Q}{X_i} * PQ$ ……...(xiii)
Semi-log;
$MPP = b_i * Q \ and \ MVP = b_i * Q * PQ$ ……… (xv)
Exponential
$MPP = \frac{b_i}{X_i} \ and \ MVP = \frac{b_i}{X_i} * PQ$ ………………(xvi)
The resource use efficiency (RUE) ratio
RUE ratio = $\frac{MVP}{P_{xi}} = \frac{MVP}{MFC}$ ………………………..(xvii)

The value of RUE lies between 0 and 1. The decision to consider if a particular resource is efficiently used or not (allocative efficiency) depends on the value of RUE (Nimoh, Tham-Agyekum, & Nyarko, 2012). When the RUE ratio = 1, resources are optimally utilized. When the RUE ratio is < 1, resources are over-utilized. Finally, when the RUE ratio is> 1, resources are underutilized. The MVP is the additional income received from using an additional unit of financial input and is derived from equation (xvii) as.

$MVP = b * P_Q$……………………………….. (xvii)

To obtain the relative percentage change in MVP of each resource needed to achieve an optimum allocation of resources, the efficiency ratio was used following the works of Mijindadi (1980) Subedi, Yuga, Meena, Bimala, Jiban, & Bidya, (2020) from (xviii) to (xix) in which;

$r = 1 \; or \; MVP = MFC$ …………………….(xviii)

Given the equation;

$D = \left(1 - \frac{MFC}{MVC}\right) X100$, Or, $D = \left(1 - \frac{1}{r}\right) X100$ ……. (xix)

Where, D = absolute value of percentage change in MVP of each resource, and r = efficiency ratio

RESULTS AND DISCUSSION

Socio-economic characteristics of respondents

The socioeconomic characteristics of the farmers were discussed with emphasis on; age, gender, marital status, education, farming experience, source of funds, and source of information. The distribution of the socioeconomic characteristics is presented in Table 1. The results from the table showed that the mean age of the farmers was 31 years with a modal age group of 41-50 years. The youngest farmer in the study area was 25 years while the eldest farmer was above 60 years old. This is an indication that rice farming was embraced by farmers of all age groups and that rice farming is more among younger people. Young farmers tend to be stronger, more capable of making good production decisions, and have more potential for greater productivity than old farmers. The table further revealed that 79.1% of the farmers were males while 20.9% were female revealing that rice production is a male-dominated activity. This was expected given that men have more access to land and other production inputs than women. Muhammad-Lawal, Memudu, Ayanlere, Mohammed, & Olajogun, 2013 in their study on rice Production had similar results and emphasized on advantages on access by men to production inputs as compared to women.

Table 2 shows the education status of the rice farmers, 6.1% had not attained any formal educational institution, 93.9% attained different levels of formal education. On average, the respondents spent 10 years informal educational institutions. While 47.8% attained secondary education, 20.9% attained tertiary education showing that the majority of the respondents were educated. While the majority of the respondents had been farming rice for more than 20 years, others practiced rice production for one year. On average, the farmers had been producing rice for 8 years. Hassan, Nwanta, & Mohammed (n.d.) had similar results in the level of experience and was of the opinion that the level of profitability could be explained in terms of the level of experience. On the aspect of funding, the study showed that while 76.5% raised their funds from personal savings, about 19.1% obtained theirs from families and friends. Another 1% obtained funds from farmer cooperative societies, 1.7% from microfinance banks, and 1.7% from NGOs. These results differ from results those obtained by Vuong (2015) on the research on; access to credit and rice production in the Mekong Delta. Results from that study showed that on average, loans taken out from formal lenders were more than those from informal credit sources. The reason was that informal lenders were charged higher interest rates. For this study, low access to credit may be explained by a lack of capital and access to rural credit. As a result, the majority of farmers have limited access to formal financial services. Further analysis of the results showed that while 69.6% of rice farmers had access to production information by radio, 7% received some information from extension agents. Also, another 7% of the farmers received information from television, family members and friends provided information to 7.8% of the farmers, while 4.3% farmers were informed through the print media, and 4.3% got information through farmer cooperative meetings. Naing, Nyein, Cho & Kyaw (2019) on their study on rice seed producers' attitudes to hybrid rice seed production in Myanmar had similar results. Radio signals covers a large area and farmer-oriented programs on rice production can reach many farmers in the local language.

Table 2; Socio-economic characteristics of the farmers

S/N	Variables	Frequency	Percentage	Mean
I	**Age (Years)**			31 years
	20-40	102	88.6	
	41-50	11	9.6	
	> 51	2	1.8	
Ii	**Gender**			
	Male	91	79.1	
	Female	24	20.9	
Iii	**Educational status**			10 years
	Nonformal	7	6.1	
	Primary	17	14.8	
	Secondary	55	47.8	
	Tertiary	24	20.9	
	Qur'an	12	10.4	
Iv	**Farming experience**			8 years
	1-5years	47	40.9	
	6-10years	37	32.2	
	11-15years	20	17.4	
	16-20years	6	5.2	
	>20years	5	4.4	
Vi	**Source of funds**			
	personal savings	88	76.5	
	family and friends	22	19.1	
	cooperative society	1	1.0	
	Micro- Finance bank	2	1.7	
	NGO	2	1.7	
Vii	**Information source**			
	Extension agent	8	7.0	
	Radio	80	69.6	
	Television	8	7.0	
	Print media	5	4.3	
	Friends and neighbors	9	7.8	
	Farmer's cooperatives	5	4.3	

Source: Field survey, 2022

Costs and returns to rice production

Table 3 shows the average cost and return associated with rice farming in the study area. An assessment of rice profitability in the study area was based on an analysis of the average costs and returns**.** The table shows that the labour cost component was the major cost item with a total cost-share of about 39.7%. This was followed by seedlings with 20.3% of the total cost. Other costs items were; fertilizer cost (6.5%), pesticide (6.2%), miscellaneous cost (5.7%), rented equipment (sickle knives, tarpaulin, wheel barrow, harvesting machine) (5.1%) and fuel (used in the lister machine to pump water for irrigation in areas that exhibited water stress) (4.7%). The total variable cost made up 88.2% of the total cost incurred in rice production. On the other hand, the total fixed costs (11.8) were made up of the depreciation costs for; threshing drums (1.1%), water sources (like earth-dames, tube-wells, wells, drainage channels estimated, 2.2%) and lister (for pumping water into the fields) 2.2%. The total revenue was estimated at ₦250000.0, the gross margin ₦284610.2 and net farm income which was ₦176922.2 shows that rice farming in the study area was profitable. The returns per naira invested was ₦2.7. This implies that for every Naira (₦1.0) invested in rice production, a profit of ₦1.7 was realized. Subedi, Yuga, Meena, Bimala, Jiban, & Bidya, (2020) and Ogechi, (2020) in their study on rice production in Nepal and in Nigeria respectively, had similar results and indicated the financial viability of rice production in their respective study areas.

Table 3: Profitability Table for a Hectare of land

Item	Value (₦)	Percentage total cost ₦
Labour	36326.1	39.7
Seedlings	18615.7	20.3
Fuel (required to be used in lister for irrigation)	4257.7	4.7
Agrochemicals	5716.5	6.2
Rented equipment (sickle knives, tarpaulin, wheel barrow, harvesting machine)	4698.3	5.1
Miscellaneous cost	5616.5	5.7
Fertilizer cost	5682.2	6.5
Total variable cost (TVC)	**80812.9**	**88.2**
Fixed cost		
Threshing drums	1000.0	1.1
Water source	2020.0	2.2
Lister (water pumping marching)	7748.0	8.5
Total fixed cost	**10768.0**	**11.8**
The total cost of production (TVC+TFC)	**91580.9**	
Total revenue	**250000.0**	
GM = (TR-TVC)	284610.2	
Net income (TR-TC)	176922.2	
Returns per investment =TR/TC	**2.7**	

Authors computation, 2022

Production function estimate

To estimate the production function in rice production, regression diagnostics were done on the inputs used in rice production using *JAMOVI 2.0* statistical software. Table 4 shows the results of a test of normality using the Shapiro-Wilk test. The value for the statistic for the Shapiro-Wilk test was 0.977. The results of the Shapiro-Wilk P-value test in the table were 0.065. This result shows that the P-value of the variables is greater than 5% statistical level and not significant. As a result, the null hypothesis of the normal distribution of the variables was accepted.

Table 4: Normality Test (Shapiro-Wilk)

Statistic	P
0.977	0.07

Source: Authors computation; 2022

A detailed analysis to test for the presence of autocorrelation of rice production variables using the Durbin-Watson (DW) test is presented in Table 5. The results for the DW statistic were 1.99, meanwhile the P-value was estimated to be 0.898. Compared with the R^2 value of 0.6168 for the double-log form of the OLS regression analysis, it was observed that the DW statistics are greater. These results show that the variables used in the analysis of inputs influencing rice production are not autocorrelated and the model could be used for prediction.

Table 5: Durbin–Watson Test for Autocorrelation

DW Statistic	P
1.99	0.898

Source: Authors computation; 2022

The results of the OLS regression model

The linear, double-log, semi-log, and exponential functional forms were used to estimate the functional form of rice producers in the study area. The results of the analysis are summarized in Table 5. The table shows three functional forms were significantly different from zero (p<0.01) as shown by the F-value. The R^2 which measures the proportion of variations in rice output as explained by variations in the predictors was 0.6168 for the double-log functional form. This revealed that the predictors account for 61.68% of the variation in the quantity of rice produced. Thus, the double-log functional form met the criteria for the "best fit," and was used in predicting rice production in the study area. Detail analysis showed that farm size, agrochemicals, seed quantity, and labour was positive and statistically significant at 1% level. The implication of these results is that a unit increase in farm size, agrochemicals, and farm labor will increase rice output by 0.63, 1.30, and 0.65 units respectively.

Geetarani and Singh (2015) had similar results and recommended increased use of input resources.

The elasticity of production

Table 6 shows the elasticity of production which was the sum of the coefficients for the double-log production function was 4.49. This suggests that rice production in the study area was in stage I. As a result, the output can be increased by increasing the level of input. This shows an increasing return to scale. Production of rice could be increased by increasing the volume of input used.

Table 6: production function estimate for rice production

Variable	Linear	Double log	Semi log	Exponential
Intercept	-4088.29(3.83)***	1.8657(6.53)***	-3273.62(-1.84)*	1.9676(10.11)***
Farm size	617.02(4.89)***	0.6300(4.23)***	3680.32(3.99)***	0.1028(4.48)***
Agrochemicals	1168.57(8.01)***	1.3019(9.19)***	5878.07(6.69)***	0.2272(8.53)***
Seed	473.12(1.13)	0.04848(0.19)	1809.29(1.14)	-0.0233(-0.30)
Labour	178.72(1.92)	0.6467(2.08)**	2834.94(1.46)	0.0357(2.11)**
Fit measures				
R^2	0.5968	0.6168	0.4862	0.6152
Adjusted R^2	0.5822	0.6028	0.4675	0.6012
F-Value	40.711	44.268	26.025	43.958
Signif. F	6.77E-21	0.0000	3.43E-15	5.4E-22
Stand. Error	2047.874	0.3726	2311.807	0.3735

*** significance at 1%, ** significance at, 5% * significance at 10% levels respectively.
Values in parenthesis represent t-values.

Estimation of the efficiency of resources used in rice production

The results of the ratio of the Marginal Value Product (MVP) and Marginal Factor Cost (MFC) ($\frac{MVP}{MFC}$) denoted by r are presented in Table 7. The r values showed that farm size (34.5), agro-chemicals (107.5), seed (138.9), and labor (21.6) were more than one indicating the underuse of these resources. The underuse of these inputs results from the high cost and timely availability in the required quantity at the required time. The results indicate that there is sufficient room to increase the use of farm size by 97.1%. Osti, Riwan, Assefa, Zhou & Dinesh (2017) in the study of spring rice production in Nepal had similar results. Further analysis shows that agrochemical could be increased by 99.07%. The results further show the possibility of increasing the quantity of seed by 92.82%. Sharma (2009) observed the underutilization of seed and recommended improvement in seed quality and quantity. Nimoh, Tham-Agyekum & Nyarko (2012) had similar results and opined that farmers could increase rice output and household income by increasing the quantity and quality of rice seeds. Labour was underused and needed 95.37% to meet up to the optimum need for increased production. The under-use of labour is related to the high demand of labour at peak periods given that manual form of labour predominates in the study area.

Table 7; Resource-use efficiency of rice farmers

Resources	**APP**	**MPP**	**MVP**	**MFC**	**R**	**Efficiency**	**Percent adjustment**
Farm size (Ha)	889.61	560.45	224181.9	6500	34.5	Underused	97.1
Agrochemicals (Kg)	1032.35	1344.01	537604.9	5000	107.5	Underused	99.07
Seed (Kg)	1796.55	87.09	34838.7	2500	13.9	Underused	92.82
Labour (man-hour)	292.77	1189.33	75734.1	3500	21.6	Underused	95.37

Source: Authors computation; 2022

CONSTRAINTS FACED BY RICE FARMERS

Table 8 show the constraints associated with rice production. Inadequate credit (70.43%) was ranked as the first challenge faced by the farmers. Despite the importance of credit in the agricultural sector, access to this resource posed a challenge. While financial institutions may not extend credit to farmers because of the risk of default, the farmers on their part may not have the collateral needed to access any loan extended to them. Labour used in the farm was not adequate and therefore a challenge. Low labour-used maybe explained by the high cost associated with its use. Rice production needs general and specialized equipment for land preparation, nursery preparation, planting, transplanting, and management and processing. Given that the specialized equipment may not be available, the farmers tend to use manual labor for the different types of farm operations and this may be costly.

About 44.34% of the farmers observed that extension services were inadequate. This may have been caused by the effect of the 'lock down' declared by the government as a precaution against COVID 19. Low extension service delivery affected all activities related to rice production in the study area. This may be observed with improved paddy processing that was observed as a major challenge. For example, the table reveals that 26.08% of the farmers complained of having a challenge in processing the paddy into milled rice. Improved techniques in parboiling, drying, and milling could be taught by extension agents with an adequate extension service delivery. About 20.0% of the respondents observed that the activities of middlemen were negatively affecting rice production. For example, variation in the price of inputs and paddy resulted from the activities of middlemen (hoarding of inputs and paddy). Inadequate knowledge (15.65%) and inadequate infrastructure (9.56%) affect rice production to varying degrees. While 15.65% of the respondents observed that their knowledge of rice production was not adequate, 9.56% opined that inadequate infrastructure was a major challenge. Infrastructure in the form of roads, machinery, and equipment are necessary for all the stages of rice production.

Table 8: Distribution of respondents based on problems of production

Constraints	Frequency	Percentage	Ranking
Inadequate capital	81	70.43	1st
Cost of labor	77	66.95	2nd
Inadequate extension service	51	44.34	3rd
Paddy processing	30	26.08	4th
Middlemen activities	23	20.00	5th
Inadequate knowledge	18	15.65	6th
Inadequate infrastructure	11	9.56	7th
Total	**378**	**253.01**	

Source: Field Survey, 2022.

CONCLUSION AND RECOMMENDATIONS

The study aimed at assessing the efficiency of resource use in rice farms in Kura LGA of Kano State, Nigeria. Results of the socio-economic analysis showed that the farmers were 31 years (on average), mainly male, educated with an average of 8 years of experience. While the source of funds was from personal savings while most of the respondents used radio as a source of information. The results of the study further showed that the rice production was a financially viable profitable enterprise. Results from regression analysis shows that the inputs used in rice production were not efficiently used. To achieve an optimum allocation of resources the inputs need to be increased. Major constraints that affect rice production were inadequate capital, labor cost, extension service, paddy processing, inadequate knowledge on rice production, post-harvest handling, and infrastructure.

It was recommended that individual farmers could make efforts to embrace improved methods of rice production. The government, NGOs, and farmer cooperatives should also improve on efforts to increase on the farmers' participatory extension service delivery. The government should ensure that agrochemicals are available to the farmers at an appropriate time and price. The government should implement a land reform policy that makes it possible for farmers to access the required farm size at affordable cost without fragmentation. A suitable and affordable mechanization method could be used to increase labour productivity by reducing the challenges that go with land preparation, weeding and other rice production practices. Research efforts should be intensified on rice varieties to improve on yield and production time.

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