

**THE DETERMINANTS OF RICE PRODUCTION IN KANO STATE:
THE IMPACTS OF ACCESS TO CREDIT**

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ABSTRACT

This study examines the determinants of rice production in Kano State, Nigeria, with particular emphasis on the impact of access to credit on smallholder farmers' productivity. Using cross-sectional data collected from 200 rice farmers selected through Yamane sampling technique across five Local Government Areas in Kano State, the study employs multiple regression analyses to investigate the relationship between credit access and rice production outcomes. The findings reveal significant constraints in accessing agricultural credit, with only 37% of sampled farmers having obtained formal credit during the farming season under review. Major barriers identified include stringent collateral requirements (87.3%), high interest rates (82.5%), and complex application procedures (76.4%). Multiple regression results demonstrate that access to credit positively impacts rice yield at a 1% significance level, with credit-accessing farmers experiencing 23% higher yields (423.71 kg/ha additional output) compared to non-accessing counterparts. The amount of credit also positively influenced productivity, with each additional ₦1000 in credit increasing yield by 3.4 kg/ha. Additionally, the study identifies key complementary factors affecting rice production, including education level (each year adding 57.63 kg/ha to yield), farming experience (34.82 kg/ha per additional year), extension contacts (76.54 kg/ha per contacts), and membership in farmers' associations (286.13 kg/ha higher yields for members). Probit regression reveals that education, farm size, association membership, and previous loan repayment history significantly increase credit access probability, while distance to credit facilities reduces it. Ordered logistic regression shows that

timeliness of credit disbursement, training on credit use, and extension contacts are critical for effective credit utilization. Based on these findings, the study recommends targeted policy interventions including specialized agricultural credit schemes with flexible collateral requirements, strengthened extension services that integrate financial education, value chain financing approaches by financial institutions, and enhanced collective action through farmers' associations to improve credit access and ultimately increase rice production in Kano State.

KEYWORDS: Rice production, agricultural credit, smallholder farmers, productivity determinants, Kano State, Nigeria.

1.0 INTRODUCTION

Rice (*Oryza sativa*) has emerged as a critical staple food crop in Nigeria, with consumption steadily rising due to population growth, increased urbanization, and shifting dietary preferences. According to the Federal Ministry of Agriculture and Rural Development (2023), Nigeria's annual rice consumption is estimated at 8 million metric tons, yet domestic production stands at approximately 5 million metric tons, creating a significant demand-supply gap that is filled through imports. This situation not only strains Nigeria's foreign exchange reserves but also undermines food security objectives and agricultural development policies.

Kano State, located in Nigeria's northwest region, represents a significant rice-producing area with substantial potential for increased production (Ibrahim et al., 2021). The state's favorable agro-ecological conditions, including suitable soil types and adequate water resources, make it particularly conducive for rice cultivation. However, despite these natural advantages, rice production in the state continues to fall below potential output levels (Adamu & Muhammad, 2022).

Among the multitude of factors constraining agricultural productivity in developing economies, limited access to financial resources ranks among the most persistently challenging (World Bank, 2024). For smallholder farmers especially, inadequate access to credit significantly restricts their ability to invest in improved technologies, high-yielding seed varieties, appropriate fertilizers, efficient irrigation systems, and other productivity-enhancing inputs (Gebrehiwot, 2022). As noted by Olagunju and Babatunde (2021), limited credit access often forces farmers into suboptimal production decisions, such as cultivating smaller land areas, using fewer inputs, or employing less efficient production methods than would be optimal.

Despite substantial evidence supporting the critical role of agricultural credit in enhancing production outcomes, empirical studies specifically examining how credit access affects rice production in Kano State remain surprisingly limited. This research gap necessitates a comprehensive investigation into the relationship between credit access and rice production outcomes in this important agricultural

region. By identifying and analyzing the specific impacts of credit access on rice farmers' productivity in Kano State, this study seeks to provide an empirical foundation for developing targeted policies and interventions aimed at improving agricultural financing mechanisms and ultimately enhancing rice production.

1.1 Problem Statement

Small-scale rice farmers in Kano State face significant challenges in accessing credit facilities, which severely constrains their productive capacity. Despite the recognized importance of credit in agricultural development, many rice farmers struggle to obtain financial resources necessary for investing in improved seeds, fertilizers, machinery, and other essential inputs. The Nigeria Agricultural Finance and Rural Development Authority (NAFRDA, 2023) reports that less than 25% of smallholder farmers in northern Nigeria have access to formal credit, with rice farmers particularly disadvantaged.

Several factors contribute to this problem, including stringent collateral requirements by financial institutions, high interest rates, complex application procedures, limited physical access to financial services in rural areas, and insufficient awareness about available credit options (Amaza et al., 2022). Additionally, many farmers lack proper documentation and formalized business structures, further impeding their ability to qualify for loans (Yakubu & Abubakar, 2023).

The consequences of poor credit access are profound and far-reaching. Without adequate financial resources, farmers are unable to adopt improved technologies and modern farming practices, resulting in lower yields and reduced income (Mahmood et al., 2022). This creates a cycle of low investment and low returns that traps many smallholder rice farmers in persistent poverty. Furthermore, the limited use of productivity-enhancing inputs contributes to Nigeria's overall rice production deficit, necessitating costly imports that drain national foreign exchange reserves.

While previous studies have explored various aspects of agricultural finance in Nigeria, there remains a critical knowledge gap regarding the specific impacts of credit access on rice production in Kano State. This study therefore seeks to address this gap by providing empirical evidence on how variations in credit access influence rice production outcomes among smallholder farmers in the region.

1.2 Research Objectives

The primary aim of this study is to examine the relationship between access to credit and rice production among smallholder farmers in Kano State, Nigeria. Specifically, the study seeks to:

1. Analyze the extent of credit access and identify the major constraints limiting smallholder rice farmers' access to credit facilities in Kano State.

2. Determine the impact of credit access on rice productivity (yield per hectare) among smallholder farmers in the study area.
3. Identify and evaluate the factors influencing effective credit utilization and its translation into improved rice production outcomes.

1.3 Research Questions

To achieve the above objectives, the study addresses the following research questions:

1. What is the current status of credit access among smallholder rice farmers in Kano State, and what major constraints do these farmers face in accessing credit?
2. To what extent does access to credit influence rice productivity (yield per hectare) among smallholder rice farmers in Kano State?
3. What factors determine the effectiveness of credit utilization in improving rice production outcomes among smallholder farmers in the study area?

2.0 Literature Review

2.1 Theoretical Framework

This study is anchored in the agricultural household model and the credit constraint theory. The agricultural household model, developed by Singh et al. (1986) and expanded by Taylor and Adelman (2003), provides a framework for understanding how farm households simultaneously make production, consumption, and labor allocation decisions. Within this model, access to credit represents a critical factor influencing production decisions by relaxing liquidity constraints and enabling optimal input allocation (Heltberg & Tarp, 2022).

The credit constraint theory, attributed to Stiglitz and Weiss (1981), explains how information asymmetries in credit markets lead to credit rationing, particularly affecting smallholder farmers who typically lack adequate collateral and credit histories. Carter (1989) extended this theory to agricultural contexts, demonstrating how credit constraints prevent farmers from adopting optimal production technologies and achieving efficient resource allocation.

Together, these theoretical frameworks suggest that improving access to credit should enhance farmers' ability to invest in productivity-improving inputs and technologies, ultimately leading to increased agricultural output. This theoretical relationship provides the conceptual foundation for examining how credit access affects rice production outcomes in Kano State.

2.2 Empirical Studies on Credit Access and Agricultural Production

Numerous empirical studies have investigated the relationship between credit access and agricultural productivity across different contexts. In Ethiopia, Gebrehiwot and van der Veen (2021) found that farmers with access to credit achieved 18% higher crop yields compared to their credit-constrained

counterparts, after controlling for other production factors. Similarly, Chandio et al. (2022) demonstrated that credit access increased wheat productivity by 23% among smallholder farmers in Pakistan.

In the Nigerian context, Oyetunde-Usman and Olagunju (2023) examined how credit access affected maize productivity across four states in northern Nigeria. Their results indicated that access to formal credit was associated with a 15.7% increase in maize yield, with the effect most pronounced among medium-scale farmers. Ibrahim et al. (2021) focused specifically on rice farmers in Jigawa State (neighboring Kano State), finding that farmers with credit access achieved 27% higher rice yields and were more likely to adopt improved rice varieties.

However, other studies present more nuanced findings. Oluwasola and Alimi (2022) found that while credit access generally improved agricultural outcomes in southwestern Nigeria, the magnitude of impact varied significantly based on loan size, timing of disbursement, and availability of complementary services. Additionally, Ojo et al. (2023) observed that in some cases, agricultural credit failed to significantly improve productivity when other constraints such as poor infrastructure, limited market access, or inadequate extension services remained unaddressed.

The literature also highlights various factors affecting credit utilization effectiveness. Amza and Hassan (2021) identified farmers' financial literacy, previous credit experience, and participation in farmer groups as significant determinants of effective credit use among cereal farmers in northern Nigeria. Similarly, Muhammad and Garba (2022) found that extension contacts, education level, and business planning skills strongly influenced how effectively farmers translated credit access into improved agricultural outcomes.

2.3 Rice Production in Kano State

Rice cultivation has a long history in Kano State, with the crop primarily grown in lowland areas and irrigated schemes. According to the Kano State Agricultural and Rural Development Authority (KNARDA, 2023), the state produces approximately 440,000 metric tons of paddy rice annually, representing about 9% of Nigeria's total rice production. The major rice-producing local government areas include Bunkure, Kura, Garun Malam, Warawa, and Wudil (Adamu & Muhammad, 2022).

Despite this substantial contribution, rice production in Kano State faces numerous challenges. Yakubu and Abubakar (2023) identified limited access to improved technologies, inadequate irrigation infrastructure, high cost of inputs, and poor access to credit as major constraints affecting rice farmers in the state. Their study found that only 23% of sampled rice farmers had access to formal credit facilities, with most relying on informal sources such as relatives, friends, and local savings groups for production financing.

Mahmood et al. (2022) further noted that rice yields in Kano State average approximately 2.8 tons per hectare, well below the potential yield of 6-8 tons per hectare achievable with optimal inputs and management practices. Their analysis suggested that closing this yield gap would require significant investments in improved seeds, appropriate fertilization, effective pest management, and efficient water use – all of which are constrained by limited access to financial resources.

2.4 Knowledge Gap

While existing literature provides valuable insights into the relationship between credit access and agricultural productivity, several gaps remain regarding this relationship in the specific context of rice production in Kano State. Most previous studies have focused on agricultural credit broadly, without specifically examining its impacts on rice farming systems. Additionally, studies conducted in other regions may not fully capture the unique socio-economic, cultural, and institutional factors that characterize agricultural financing in Kano State.

Furthermore, prior research has typically employed binary measures of credit access (i.e., access versus no access), without adequately considering variations in credit amounts, sources, terms, and utilization patterns. This study addresses these gaps by providing a more nuanced analysis of how different dimensions of credit access influence rice production outcomes in Kano State, thus contributing to both the theoretical understanding of agricultural finance and the practical development of more effective credit policies for smallholder rice farmers.

3.0 Methodology

3.1 Study Area

This study was conducted in Kano State, located in northwestern Nigeria between latitudes 10°33' and 12°37' north and longitudes 7°34' and 9°25' east. Covering approximately 20,131 square kilometers, Kano State is Nigeria's most populous state with an estimated population of 13.4 million (National Population Commission, 2023). The state experiences a tropical dry and wet climate with an average annual rainfall of 600-900mm, concentrated between May and October.

Agriculture constitutes the primary economic activity in Kano State, employing approximately 70% of the working population. The state's agricultural sector is characterized by smallholder farming, with average farm sizes ranging from 0.5 to 2.5 hectares. Major crops cultivated include rice, maize, millet, sorghum, cowpea, and vegetables. Rice cultivation is particularly important, with production occurring in both rainfed lowland areas and irrigation schemes, notably the Kano River Irrigation Project (KRIP) and the Hadejia Valley Irrigation Project (HVIP).

3.2 Sampling Procedure and Sample Size

The study employed a multi-stage sampling technique to select respondents. In the first stage, five Local Government Areas (LGAs) were purposively selected based on their prominence in rice production: Bunkure, Kura, Garun Malam, Warawa, and Wudil. In the second stage, two rice-producing communities were randomly selected from each LGA, yielding a total of ten communities. Finally, smallholder rice farmers were randomly selected from each community using a list of registered farmers obtained from the Kano State Agricultural and Rural Development Authority (KNARDA).

The sample size was determined using Yamane's (1967) formula:

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

Where:

n = sample size

N = population size (2,850 registered smallholder rice farmers in the selected LGAs)

e = level of precision (0.07 or 7%)

By substituting on the formular:

$$n = 2,850 / (1 + 2,850(0.07)^2)$$

$$n = 2,850 / (1 + 13.9865)$$

$$n = 2,850 / 14.9865$$

$$n = 190.17$$

The sample size was rounded up to 200 to account for potential non-responses and ensure adequate representation. The respondents were proportionally allocated across the selected communities based on the number of registered rice farmers in each community.

3.3 Data Collection

Primary data were collected using a structured questionnaire administered through face-to-face interviews between January and March 2024. The questionnaire was designed to gather information on farmers' socioeconomic characteristics, farm-specific attributes, credit access status, credit utilization patterns, rice production practices, input use, yields, and challenges faced in accessing and utilizing credit.

To ensure data quality, the questionnaire was pretested with 20 rice farmers from non-sampled communities, and necessary modifications were made based on feedback received. Additionally, four trained enumerators fluent in Hausa (the local language) were engaged to assist with data collection. The questionnaire was translated into Hausa to facilitate communication with respondents who were not proficient in English.

3.4 Analytical Framework

3.4.1 Descriptive Statistics

Descriptive statistics including frequencies, percentages, means, and standard deviations were used to analyze the extent of credit access and identify constraints limiting smallholder rice farmers' access to credit facilities. Additionally, t-tests and chi-square tests were employed to compare various characteristics between farmers with and without credit access.

3.4.2 Multiple Linear Regression Model

To determine the impact of credit access on rice productivity (Objective 2), a multiple linear regression model was specified as follows:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \beta_7 X_{7i} + \beta_8 X_{8i} + \varepsilon_i \dots \dots \dots (1)$$

Where:

Y_i = Rice yield (kg/ha) of farmer i

X_1 = Credit access (1 if farmer accessed credit, 0 otherwise)

X_2 = Credit amount (Naira)

X_3 = Age of farmer (years)

X_4 = Education level (years of formal education)

X_5 = Farming experience (years)

X_6 = Farm size (hectares)

X_7 = Household size (number)

X_8 = Membership of farmers' association (1 if member, 0 otherwise)

β_0 = Constant term

β_1 to β_{11} = Regression coefficients

ε_i = Error term

3.4.3 Probit Regression Model

To investigate the determinants of credit access among smallholder rice farmers, a probit regression model was employed:

$$\Pr(Y=1|X) = \Phi(\beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \beta_7 X_{7i} + \beta_8 X_{8i}) \dots \dots \dots (2)$$

Where:

$\Pr(Y=1|X)$ = Probability of a farmer accessing credit

Φ = Cumulative distribution function of the standard normal distribution

X_1 = Age of farmer (years)

X_2 = Gender (1 if male, 0 if female)

X_3 = Education level (years of formal education)

X_4 = Farming experience (years)

X_5 = Farm size (hectares)

X_6 = Household size (number)

X_7 = Membership of farmers' association (1 if member, 0 otherwise)

X_8 = Off-farm income (Naira)

β_0 = Constant term

β_1 to β_{10} = Regression coefficients

3.4.4 Ordered Logistic Regression Model

To identify factors influencing effective credit utilization (Objective 3), an ordered logistic regression model was specified. This model was appropriate given that the dependent variable (credit utilization effectiveness) was measured on an ordinal scale. The model was specified as:

$$\text{Logit} [\Pr(Y \leq j)] = \alpha_j - (\beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i}) \dots \dots \dots (3)$$

Where:

Y = Level of credit utilization effectiveness (1 = Low, 2 = Medium, 3 = High)

α_j = Threshold parameters

X_1 = Education level (years of formal education)

X_2 = Farming experience (years)

X_3 = Extension contacts (number of contacts in the past year)

X_4 = Credit amount (Naira)

X_5 = Training on credit use (1 if received, 0 otherwise)

X_6 = Membership of farmers' association (1 if member, 0 otherwise)

β_1 to β_8 = Regression coefficients

4.0 RESULTS AND DISCUSSION

4.1 Socioeconomic Characteristics of Respondents

Table 1: Socioeconomic Characteristics of Respondents (N=200)

Characteristic	Category	Frequency	Percentage
Gender	Male	157	78.5
	Female	43	21.5
		200	100%
Age (years)	≤ 30	37	18.5
	31-40	68	34.0
	41-50	59	29.5
	51-60	28	14.0
	> 60	8	4.0
	Mean = 43.7, SD = 1.3	200	100%
Educational level	No formal education	77	38.5
	Primary education	43	21.5
	Secondary education	49	24.5
	Tertiary education	31	15.5
		200	100%

Household size	1-5	52	26.0
	6-10	113	56.5
	11-15	29	14.5
	> 15	6	3.0
	Mean = 8.3, SD = 3.4	200	100%
Farming experience (years)	≤ 5	18	9.0
	6-10	44	22.0
	11-15	53	26.5
	16-20	43	21.5
	> 20	42	21.0
	Mean = 16.8, SD = 8.7	200	100%
Farm size (hectares)	< 1	64	32.0
	1-2	79	39.5
	2.1-3	39	19.5
	> 3	18	9.0
	Mean = 1.7, SD = 1.1	200	100%

The study population consists predominantly of male farmers (78.5%), with a relatively mature average age of 43.7 years. Most farmers fall in the 31-50 age bracket (63.5%), indicating a workforce in their productive years but potentially lacking youth participation. Education levels show concerning trends with 38.5% having no formal education, which could impact adoption of modern farming techniques and credit accessibility. Only 15.5% have tertiary education, suggesting potential limitations in financial literacy.

Household sizes are relatively large (mean of 8.3 persons), with most households (56.5%) having 6-10 members. This indicates significant household labor availability but also substantial household expenses and responsibilities. Farming experience is considerable (mean of 16.8 years), with 69% of farmers having more than 10 years of experience, suggesting well-established farming knowledge but potentially traditional practices. Farm sizes are predominantly small, with 71.5% of farmers cultivating less than 2 hectares (average 1.7 hectares), confirming their smallholder status and likely subsistence-focused production with limited economies of scale.

Table 2: Multiple Linear Regression Results on Factors Affecting Rice Yield

Variable	Coefficient	Std. Error	t-value	p-value	Sig.
Constant	1243.57	236.48	5.26	0.000	***
Credit access	423.71	113.52	3.73	0.000	***
Credit amount (₦)	0.0034	0.0015	2.27	0.025	**
Age (years)	-5.83	6.45	-0.90	0.368	NS
Education level (years)	57.63	22.84	2.52	0.013	**
Farming experience (years)	34.82	14.97	2.33	0.021	**
Farm size (hectares)	-128.46	43.25	-2.97	0.003	***
Household size (number)	15.23	19.76	0.77	0.442	NS
Extension contacts (number)	76.54	23.57	3.25	0.001	***
Membership of farmers' association (1=Yes, 0=No)	286.13	112.84	2.54	0.012	**
Distance to nearest credit facility (km)	-25.37	13.46	-1.89	0.061	*
Off-farm income (₦'000)	0.072	0.039	1.85	0.067	*
R ²	0.683				
Adjusted R ²	0.665				
F-statistic	37.42***				

Coefficient of Determination: The model explains 68.3% of the variation in rice yield ($R^2 = 0.683$), indicating strong explanatory power of the included variables. Farmers with access to formal credit produce 423.71 kg/ha more rice than those without access, demonstrating a substantial and highly significant productivity advantage. Credit Amount, each additional ₦1000 in credit increases rice yield by 3.4 kg/ha, confirming that greater financial resources enable more productive investments. Education Level, each year of formal education adds 57.63 kg/ha to rice yield, highlighting education's significant role in improving agricultural productivity.

Farming Experience, rice yield increases by 34.82 kg/ha for each additional year of farming experience, showing the value of accumulated practical knowledge. Farm Size: Rice yield decreases by 128.46 kg/ha for each additional hectare of land, revealing an inverse relationship between farm size and productivity intensity. Extension Contacts, each additional extension contacts increases rice yield by 76.54 kg/ha, demonstrating the critical importance of agricultural advisory services. Farmers' Association Membership, members of farmers' associations achieve 286.13 kg/ha higher yields than non-members, underlining the substantial benefits of collective action and knowledge sharing. Distance to Credit Facility, rice yield decreases by 25.37 kg/ha for each additional kilometer from credit facilities, illustrating how physical access to financial services impacts productivity. Off-farm Income: Each additional ₦1000 of non-farm income increases rice yield by 0.072 kg/ha, suggesting modest reinvestment of alternative income into farming operations.

Table 3: Probit Regression Results on Determinants of Credit Access (N=200).

Variable	Coefficient	Std Error	z-value	p-value	Marginal Effect	Sig.
Constant	-4.286	0.853	-5.02	0.000		***
Age (years)	0.007	0.012	0.58	0.560	0.002	NS
Gender	0.253	0.317	0.80	0.425	0.068	NS
Education level (years)	0.157	0.042	3.74	0.000	0.043	***
Farming experience (years)	0.027	0.019	1.42	0.155	0.007	NS
Farm size (hectares)	0.293	0.109	2.69	0.007	0.080	***
Household size (number)	-0.031	0.037	-0.84	0.403	-0.008	NS
Membership of farmers' association (1=Yes, 0=No)	0.731	0.266	2.75	0.006	0.198	***
Distance to nearest credit facility (km)	-0.083	0.032	-2.59	0.010	-0.023	**
Off-farm income (₦'000)	0.0002	0.0001	2.00	0.045	0.00005	**
Previous loan repayment history (1=Favorable, 0=Otherwise)	1.134	0.283	4.01	0.000	0.307	***
Log likelihood	-93.65					
Pseudo R ²	0.418					
Correctly predicted (%)	73.5					
LR chi ² (10)	134.82***					

Coefficient of Determination: The model explains 41.8% of variation in credit access (Pseudo R² = 0.418) with 73.5% correct prediction rate, indicating good predictive capacity. Education Level, each additional year of education increases the probability of accessing credit by 4.3%, demonstrating education's role in enhancing financial inclusion. Farm Size, each additional hectare of land increases credit access probability by 8%, showing lenders' preference for farmers with larger operations as borrowers. Farmers' Association Membership, being a member of a farmers' association increases credit access probability by 19.8%, highlighting the value of social capital in lending decisions. Distance to Credit Facility, each additional kilometer from the nearest credit facility reduces access probability by 2.3%, confirming the importance of physical proximity to financial institutions.

Off-farm Income, each additional ₦1000 of non-farm income increases credit access probability by 0.005%, indicating income diversification slightly improves creditworthiness. Previous Loan Repayment History, farmers with favorable repayment history have 30.7% higher probability of accessing credit, making this the strongest predictor of credit approval.

Table 4: Ordered Logistic Regression Results on Factors Influencing Credit Utilization Effectiveness (N=74).

Variable	Coefficient	Standard Error	z-value	p-value	Sig.
Education level (years)	0.243	0.098	2.48	0.013	**
Farming experience (years)	0.032	0.025	1.28	0.201	NS
Extension contacts (number)	0.382	0.114	3.35	0.001	***
Credit amount (₦'000)	0.0013	0.0007	1.86	0.063	*
Timeliness of credit (1=Timely, 0=Otherwise)	1.476	0.465	3.17	0.002	***
Financial literacy (index)	0.295	0.121	2.44	0.015	**
Training on credit use (1=Yes, 0=No)	1.082	0.398	2.72	0.007	***
Membership of farmers' association (1=Yes, 0=No)	0.764	0.377	2.03	0.043	**
/cut1	2.237	0.633			
/cut2	4.892	0.758			
Log likelihood	-53.48				
Pseudo R ²	0.379				
LR chi ² (8)	65.37***				

Coefficient of Determination: The model explains 37.9% of variation in credit utilization effectiveness ($R^2 = 0.379$), indicating moderate explanatory power.

Education Level, each additional year of education increases the log odds of more effective credit utilization by 0.243, confirming educated farmers make better financial decisions. Extension Contacts, each additional extension contacts increases the log odds of effective credit utilization by 0.382, demonstrating how agricultural advisory services improve financial management. Credit Amount, each additional ₦1000 in credit increases the log odds of effective utilization by 0.0013, suggesting larger loans enable more comprehensive farm investments. Timeliness of Credit, receiving credit at the appropriate time in the farming cycle increases the log odds of effective utilization by 1.476, making this the most critical factor for credit effectiveness.

Financial Literacy, each unit increase in financial literacy increases the log odds of effective credit utilization by 0.295, highlighting the importance of financial knowledge. Training on Credit Use, farmers who received training on credit use have log odds of effective utilization increased by 1.082, demonstrating the strong impact of targeted financial education. Farmers' Association Membership, being a member of a farmers' association increases the log odds of effective credit utilization by 0.764, confirming the value of collaborative learning environments.

5.0 DISCUSSION

5.1 Status of Credit Access Among Smallholder Rice Farmers

This study revealed that only 37% (74 out of 200) of the sampled rice farmers in Kano State had access to formal credit facilities during the farming season under review. This finding aligns with the report by the Nigeria Agricultural Finance and Rural Development Authority (NAFRDA, 2023),

which estimated that less than 25% of smallholder farmers in northern Nigeria have access to formal credit. However, our slightly higher percentage could be attributed to the study's focus on rice farmers who might have benefited from recent government initiatives targeting the rice value chain as part of efforts to reduce imports.

The low credit access rate observed in this study reflects the persistent financial exclusion facing smallholder farmers in Nigeria's agricultural sector. Most farmers without access to formal credit (63%) reported relying on informal sources such as relatives, friends, rotating savings and credit associations (ROSCAs), and local moneylenders to finance their farming operations. These informal sources, while providing some financial relief, typically offer limited amounts with unfavorable terms that may not adequately support optimal production investments.

The primary constraints to credit access identified by respondents included stringent collateral requirements (87.3%), high interest rates (82.5%), complex application procedures (76.4%), lack of awareness about available credit options (68.3%), and distance to financial institutions (64.2%). These findings corroborate those of Yakubu and Abubakar (2023), who identified similar constraints among smallholder farmers in Kano State. The probit regression results further affirmed these constraints, showing that physical distance to credit institutions significantly reduced the probability of credit access.

Additionally, the results revealed significant disparities in credit access based on education level, farm size, and membership in farmers' associations. Farmers with higher education levels were more likely to access credit, possibly due to better financial literacy, greater awareness of available credit options, and enhanced ability to navigate complex application procedures. This finding supports Amza and Hassan's (2021) assertion that farmers' financial literacy significantly influences their credit access and utilization.

Farm size emerged as another significant determinant of credit access, with larger farm operations having higher probabilities of obtaining credit. This pattern suggests that financial institutions may be using farm size as a proxy for repayment capacity, potentially disadvantaging the smallest and most vulnerable farmers who arguably need credit support the most. This credit rationing behavior aligns with the credit constraint theory proposed by Stiglitz and Weiss (1981), which posits that information asymmetries in credit markets lead to exclusion of certain borrower categories. Membership in farmers' associations substantially increased the probability of credit access (by 19.8%), highlighting the critical role of social capital in overcoming credit constraints. Through associations, farmers likely benefit from improved information flow, collective bargaining power, and in some cases, group lending arrangements that reduce individual collateral requirements. This finding reinforces the

importance of collective action in addressing smallholder farmers' financial challenges, as previously noted by Muhammad and Garba (2022).

Perhaps most striking among the determinants of credit access was the influence of previous loan repayment history, which increased the probability of credit access by 30.7%. This suggests that once farmers establish creditworthiness through successful prior borrowing, their subsequent access to credit substantially improves. While this practice is understandable from lenders' risk management perspective, it creates a challenging "chicken and egg" situation for first-time borrowers who cannot demonstrate repayment history without first accessing credit.

5.2 Impact of Credit Access on Rice Productivity

The multiple regression analysis revealed that access to credit significantly and positively influenced rice productivity, with credit-accessing farmers achieving yields approximately 23% higher than their non-accessing counterparts. This productivity differential translates to 423.71 kg/ha additional rice output, a substantial gain that underscores credit's critical role in enhancing agricultural performance. The finding aligns with Ibrahim et al.'s (2021) study in neighboring Jigawa State, which found a 27% yield advantage among credit-accessing rice farmers.

The positive relationship between credit access and productivity can be explained through several mechanisms. First, credit enables timely procurement of yield-enhancing inputs such as improved seeds, fertilizers, and crop protection products. During the survey, it was observed that credit-accessing farmers applied an average of 293 kg/ha of fertilizer, compared to 187 kg/ha among non-accessing farmers. This substantial difference in input use directly translates to higher yields, as adequate fertilization is crucial for optimal rice performance.

Second, credit facilitates investment in labor-saving and productivity-enhancing technologies. Farmers with credit access reported higher use of mechanical land preparation (68% versus 37% among non-accessing farmers) and improved water management practices (53% versus 29%). These technologies reduce production bottlenecks and allow for more timely farming operations, which are critical for maximizing yield potential.

Third, credit access enables better risk management through investments in irrigation infrastructure and diversified crop protection strategies. This allows farmers to mitigate production risks associated with rainfall variability and pest/disease outbreaks, leading to more stable and higher average yields over time.

Interestingly, the study found that not only credit access but also the amount of credit significantly influenced productivity. Each additional ₦1000 in credit was associated with a 3.4 kg/ha increase in rice yield, suggesting that sufficient credit volume is necessary to generate meaningful productivity

improvements. This finding speaks to the importance of not just expanding credit access but also ensuring that loan amounts are adequate to support comprehensive farm investments across multiple production components. The study also found that the relationship between credit and productivity is moderated by several complementary factors. Education level, farming experience, extension contacts, and membership in farmers' associations all positively influenced rice productivity. This suggests that credit's effectiveness depends partly on farmers' human and social capital attributes that enhance their ability to make optimal production decisions. Similarly, the negative relationship between distance to credit facilities and productivity indicates that physical accessibility of financial services remains an important consideration in agricultural finance policies.

5.3 Factors Influencing Effective Credit Utilization

The ordered logistic regression revealed several key factors that determined how effectively farmers translated credit access into improved production outcomes. Timeliness of credit emerged as the most influential factor, with timely disbursement increasing the log odds of effective utilization by 1.476. This finding highlights a critical challenge in agricultural lending: credit that arrives after the optimal window for input application or technology adoption has limited productivity impact. During focus group discussions, farmers frequently mentioned that delays in loan disbursement forced them to divert credit to non-productive uses or apply inputs at suboptimal times, reducing their effectiveness.

Training on credit use also significantly enhanced utilization effectiveness (log odds increased by 1.082), suggesting that financial resources must be complemented with knowledge resources for optimal outcomes. Farmers who received specific training on efficient credit allocation reported more strategic input purchases, better timing of farming operations, and more precise resource allocation across different production activities. This finding supports Muhammad and Garba's (2022) observation that farmers' business planning skills strongly influence how effectively they translate credit access into improved agricultural outcomes.

Extension contacts similarly improved credit utilization effectiveness, with each additional extension visit increasing the log odds by 0.382. This underscores the complementary relationship between financial services and agricultural advisory services in enhancing farm productivity. Extension agents not only provide technical production guidance but also offer advice on optimal resource allocation and input selection, which enhances the productive impact of credit. This finding suggests that coordinating credit provision with extension delivery could magnify the benefits of agricultural finance interventions.

Education level and financial literacy both positively influenced credit utilization effectiveness, increasing the log odds by 0.243 and 0.295, respectively. These findings highlight the importance of human capital in determining credit outcomes. Better-educated farmers with higher financial literacy

likely make more informed decisions about loan allocation, input selection, and technology adoption, resulting in more efficient credit use. This supports Amza and Hassan's (2021) finding that financial literacy significantly determines effective credit use among cereal farmers in northern Nigeria.

Membership in farmers' associations also enhanced credit utilization effectiveness (log odds increased by 0.764), reinforcing the importance of social learning and peer support in agricultural finance. Through associations, farmers share experiences about effective input combinations, reliable input suppliers, and successful production practices, which likely improves their credit-financed investment decisions. This collaborative learning environment appears particularly valuable in contexts where formal agricultural education and extension services may be limited.

5.4 Contextual Factors Affecting Rice Production and Credit Effectiveness

The study's findings must be interpreted within the broader context of rice farming in Kano State. The average rice yield among sampled farmers was 2.9 tons per hectare, which, while slightly higher than the 2.8 tons per hectare reported by Mahmood et al. (2022), remains far below the potential yield of 6-8 tons per hectare achievable with optimal inputs and management practices. This persistent yield gap indicates that credit access, while important, is just one of several interrelated factors constraining rice productivity in the region.

Other contextual factors observed during the study included infrastructural limitations (particularly irrigation facilities), climate variability, land tenure insecurity, and market access constraints. These factors moderated the effectiveness of credit in several ways. For instance, farmers in areas with poor irrigation infrastructure reported lower returns to credit-financed investments due to water availability constraints. Similarly, farmers facing high transaction costs in accessing input and output markets derived less benefit from credit access compared to those with better market connectivity.

The socioeconomic characteristics of the farming population also influenced credit outcomes. The predominance of male farmers (78.5%) in the sample reflects gender disparities in resource access, including credit. Female farmers reported additional constraints to credit access, including cultural barriers, limited land ownership, and restricted mobility. Educational limitations were also prominent, with 38.5% of farmers having no formal education, which likely impedes their ability to navigate formal credit systems and optimize credit use. These findings highlight the importance of considering social equity dimensions in agricultural credit programs.

Furthermore, the small average farm size (1.7 hectares) among respondents likely limits economies of scale in production and may reduce the attractiveness of these farmers to formal lenders. Interestingly, the regression results showed an inverse relationship between farm size and yield, with productivity decreasing by 128.46 kg/ha for each additional hectare. This finding, while counterintuitive from an

economies of scale perspective, is consistent with the inverse farm size-productivity relationship often observed in smallholder farming systems. Smaller farms typically apply more intensive management and labor per unit area, which may partially compensate for limited mechanization and capital investments.

6. Conclusion and Recommendations

6.1 Conclusion

This study examined the relationship between access to credit and rice production among smallholder farmers in Kano State, Nigeria. The findings revealed significant constraints in accessing agricultural credit, with only 37% of the sampled farmers having obtained formal credit during the farming season under review. Major barriers to credit access included stringent collateral requirements, high interest rates, complex application procedures, limited awareness of available credit options, and physical distance to financial institutions.

The study established that access to credit significantly enhances rice productivity, with credit-accessing farmers achieving 23% higher yields compared to non-accessing counterparts. This productivity differential was attributed to credit-facilitated investments in improved inputs, better farming technologies, and enhanced risk management strategies. The amount of credit obtained also positively influenced productivity, suggesting the importance of adequate loan sizes in generating meaningful production improvements. Several factors were found to moderate the relationship between credit access and productivity, including farmers' education level, farming experience, extension contacts, and membership in farmers' associations. These complementary factors enhanced farmers' ability to effectively translate credit access into improved production outcomes. Similarly, the effectiveness of credit utilization was influenced by the timeliness of disbursement, financial literacy, targeted training on credit use, and participation in collaborative learning environments.

The study's findings support the theoretical propositions of the agricultural household model and credit constraint theory. Credit access relaxed liquidity constraints, enabling farmers to make more optimal production decisions and investments. However, information asymmetries and institutional barriers continued to exclude many farmers from formal credit markets, particularly those with limited education, smaller farm operations, and weaker social networks.

While credit access emerged as a significant determinant of rice productivity, the persistence of a substantial yield gap between actual and potential production levels indicates that credit is necessary but not sufficient for transforming rice farming systems in Kano State. Complementary investments in irrigation infrastructure, extension services, farmer education, and market development are equally important for unlocking the full productive potential of the region's rice sector.

6.2 Recommendations

Based on the study's findings, the following recommendations are proposed:

6.2.1 For Policy Makers

1. Establish Specialized Agricultural Credit Schemes: Government should establish dedicated credit facilities for smallholder rice farmers with flexible collateral requirements, reasonable interest rates, and simplified application procedures. These schemes should consider the unique characteristics and needs of rice farming systems in Kano State.
2. Promote Financial Inclusion: Policies should aim to expand the reach of financial institutions in rural areas through incentives for bank branch expansion, mobile banking services, and agent banking models. Additionally, digital financial services tailored to agricultural cycles should be promoted to reduce transaction costs.
3. Coordinate Credit with Input Supply: Government should ensure that credit provision is synchronized with the availability of quality inputs by strengthening input supply systems and coordinating credit disbursement with optimal planting periods.
4. Support Farmers' Associations: Policy support for forming and strengthening farmers' associations would enhance collective bargaining power and facilitate group lending models that reduce individual collateral requirements.
5. Develop Agricultural Value Chain Financing Models: Financial institutions should move beyond traditional collateral-based lending to embrace value chain financing approaches that leverage relationships between farmers, input suppliers, processors, and marketers.
6. Implement Flexible Repayment Schedules: Loan repayment terms should align with rice farming cash flow patterns, with principal payments coinciding with harvest periods when farmers have the highest income.
7. Provide Financial Literacy Training: Banks and microfinance institutions should incorporate financial education components into their agricultural lending programs to enhance farmers' credit management capabilities.

REFERENCES

1. Adamu, I. A., & Muhammad, L. A. (2022). Analysis of rice production and marketing in Kano State, Nigeria. *Journal of Agricultural Economics and Rural Development*, 14(3), 125-137.
2. Amaza, P. S., Mohammed, S. T., & Abdoulaye, T. (2022). Agricultural credit constraints and their implications for food security: Evidence from smallholder farmers in northern Nigeria. *Food Security*, 14(4), 891-908. <https://doi.org/10.1007/s12571-022-01267-y>
3. Amza, R., & Hassan, M. B. (2021). Determinants of effective credit utilization among cereal farmers in northern Nigeria. *International Journal of Agricultural Economics*, 6(5), 239-248. <https://doi.org/10.11648/j.ijae.20210605.14>

4. Carter, M. R. (1989). The impact of credit on peasant productivity and differentiation in Nicaragua. *Journal of Development Economics*, 31(1), 13-36. [https://doi.org/10.1016/0304-3878\(89\)90029-1](https://doi.org/10.1016/0304-3878(89)90029-1)
5. Chandio, A. A., Jiang, Y., Wei, F., & Guangshun, X. (2022). Effects of agricultural credit on wheat productivity of small farms in Sindh, Pakistan. *Agricultural Finance Review*, 82(1), 83-96. <https://doi.org/10.1108/AFR-02-2017-0010>
6. Federal Ministry of Agriculture and Rural Development. (2023). Agricultural transformation agenda: Rice value chain implementation plan. FMARD Publication.
7. Gebrehiwot, K. G. (2022). The impact of agricultural credit on farm productivity: Evidence from Ethiopia. *Agricultural Finance Review*, 82(3), 513-532. <https://doi.org/10.1108/AFR-02-2021-0016>
8. Gebrehiwot, K. G., & van der Veen, A. (2021). Credit constraints and smallholder farmers' technical efficiency: Evidence from Ethiopia. *Agricultural Economics Review*, 22(1), 78-99.
9. Heltberg, R., & Tarp, F. (2022). Agricultural supply response and poverty in Mozambique. *The European Journal of Development Research*, 34(1), 174-196. <https://doi.org/10.1057/s41287-021-00413-0>
10. Ibrahim, H. Y., Ojo, T. O., & Oyetunde-Usman, Z. (2021). Effect of agricultural credit access on rice production in Jigawa State, Nigeria. *Nigerian Journal of Agricultural Economics*, 11(1), 63-75.
11. Kano State Agricultural and Rural Development Authority (KNARDA). (2023). Annual agricultural performance report. KNARDA Publication.
12. Mahmood, H. Z., Qasim, M., Khan, M., & Ahmad, S. (2022). Analysis of yield gap and constraints to higher rice productivity in northern Nigeria. *Journal of Agriculture and Food Research*, 10, 100368. <https://doi.org/10.1016/j.jafr.2022.100368>
13. Muhammad, L. A., & Garba, A. (2022). Determinants of agricultural credit use among smallholder farmers in northwestern Nigeria. *International Journal of Agricultural Management and Development*, 12(2), 177-189.
14. National Population Commission. (2023). Demographic statistics bulletin. NPC Publication.
15. Nigeria Agricultural Finance and Rural Development Authority (NAFRDA). (2023). Agricultural credit access survey report. NAFRDA Publication.
16. Ojo, T. O., Baiyegunhi, L. J. S., & Salami, A. O. (2023). Credit constraints and agricultural productivity in Nigeria: When does it matter? PLoS ONE, 18(4), e0282641. <https://doi.org/10.1371/journal.pone.0282641>
17. Olagunju, K. O., & Babatunde, R. O. (2021). Impact of credit on agricultural productivity: Evidence from smallholder cassava farmers in Nigeria. *Agricultural Finance Review*, 81(5), 681-699. <https://doi.org/10.1108/AFR-02-2020-0019>

18. Oluwasola, O., & Alimi, T. (2022). Agricultural credit and rural development in southwestern Nigeria: Potential and limitations. *Journal of Rural Economics and Development*, 9(2), 118-131.
19. Oyetunde-Usman, Z., & Olagunju, K. O. (2023). Does credit access matter for agricultural technology adoption? Evidence from rural households in northern Nigeria. *Technology in Society*, 72, 102145. <https://doi.org/10.1016/j.techsoc.2022.102145>
20. Singh, I., Squire, L., & Strauss, J. (1986). *Agricultural household models: Extensions, applications, and policy*. Johns Hopkins University Press.
21. Stiglitz, J. E., & Weiss, A. (1981). Credit rationing in markets with imperfect information. *The American Economic Review*, 71(3), 393-410.
22. Taylor, J. E., & Adelman, I. (2003). Agricultural household models: Genesis, evolution, and extensions. *Review of Economics of the Household*, 1(1-2), 33-58. <https://doi.org/10.1023/A:1021847430758>
23. World Bank. (2024). *Agriculture finance and the sustainable development goals*. World Bank Group.
24. Yakubu, S., & Abubakar, H. (2023). Constraints to agricultural financing among smallholder farmers in Kano State, Nigeria. *Nigerian Journal of Rural Sociology*, 23(2), 67-79.
25. Yamane, T. (1967). *Statistics: An introductory analysis* (2nd ed.). Harper and Row.