

FINANCING CLIMATE-SMART AGRICULTURAL PRACTICES OF RICE FARMERS IN EBONYI STATE, NIGERIA

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ABSTRACT

Financing climate-smart agricultural practices of rice farmers in Ebonyi State, Nigeria was investigated. Rice farmers numbering 240 were obtained via multi-stage sampling. Questionnaire was used to collect required data and were analyzed using chart, percentage, and probit regression model. Results showed that farmers were aware of changing climate and practiced various climate-smart agricultural techniques such as crop diversification (96.2%), improved water management techniques (95.0%), soil conservation practices (94.7%), integrated pest management (82.5%) and improved crop varieties (80.8%). Sources of climate-smart financing includes personal savings (96.5%), rural money lenders (92.7%), agricultural cooperatives (91.1%), foreign supports (80.6%) and credit supports from political office holders. Lack of basic information ($P < -0.01$), complicated bank application processes ($P < -0.05$), lack of required collateral ($P < -0.01$), illiteracy ($P < -0.01$), bureaucratic bottlenecks ($P < -0.05$) and high interest rates ($P < -0.05$) constrained financing access of climate-smart agricultural techniques. Pests and diseases, climate variability and change, high cost of inputs, poor access to improved seed varieties, low mechanization and high post-harvest losses were major challenges encountered in rice production. The study recommends the government and other relevant stake-holders to intensify efforts in financing climate-smart agricultural practices of local farmers; this will help mitigate climate change and further improve rice production and profitability of rice farmers.

Keywords: Financing, climate-smart, agricultural practices, rice farmers

1.0 INTRODUCTION

All over the world, agriculture is besieged with varying climatic issues ranging from increased temperatures, unpredictable rainfall, windstorms and more frequent drought seasons affecting global food supply and security particularly in areas where rain-fed agriculture is prevalent (Yuan et al., 2024). In Nigeria, rice production plays an important role both in gross domestic product contributions and food security of many households. It also offers employment opportunities to several local farmers who rely on rice cultivation as a source of economic livelihoods and up-keeps (Sanusi et al., 2025). However, a number of obstacles affect Nigerian rice production, such as climatic change, restricted financial resources, poor infrastructure, and a low uptake of contemporary technologies (Sanogo et al., 2023). First, the production of rice in Nigeria has been negatively impacted by climate change. Significant obstacles to rice farming in the country include wind storms, water scarcity, variable rainfall patterns, rising temperatures, and relative humidity (Nagaraj et al., 2024). These modifications may result in lower yields, endangering both food security and the existence of innumerable farmers who rely on rice as their main source of earnings. Ebonyi State has over 70% of the farmers engaged in rice cultivation and is widely known as the rice hub of the country (*Abakaliki rice*) (Anyanwu et al., 2022). The state has had its share of adverse changes in climate and weather conditions. Unpredictable rainfall patterns disturb rice planting dates, resulting in a poor harvest, while rising temperatures interfere with the growth and development of rice crops. Low relative humidity drains soil-water moisture contents leading to stunted growth and crop failures. Degrading soil, flooding, and destructive windstorms make matters worse for rice growers in the state (Osuji et al., 2023). However, considering the importance of agriculture in food production in the state, there is need to embrace improved agricultural practices that mitigate adverse climatic changes. Under these circumstances, climate-smart farming methods that incorporate cutting-edge technology and data-driven strategies have become more popular (Kabato et al., 2025). Climate-smart agricultural practices are a collection of tools and methods that improve farming operations' sustainability, efficiency, and productivity. Precision farming, irrigation systems, mechanization, better seeds, and digital tools for observation and making decisions are a few examples of these methods (Akinwale et al., 2023). Additionally, it uses cutting-edge technology like data analytics, the Internet of Things (IoT), and remote sensing to lower environmental effects, increase crop output, and optimize resource utilization (Kabato et al., 2025). Adopting climate-smart agricultural methods can also help rice farmers boost their yields, lower post-harvest losses, and boost total farm profitability and productivity.

However, smallholder farmers sometimes find it difficult to make the significant financial commitments necessary to implement climate-smart farming techniques. Many farmers have limited access to official financial institutions and struggle to get credit facilities or loans. Furthermore, farmers find it increasingly difficult to obtain finance for agricultural investments due to high interest rates, strict collateral requirements, and a lack of financial literacy (Hiranya and Joshi, 2025). The World Bank reports that just 1.4% of Nigerian farmers are able to obtain credits from formal financial institutions (World Bank, 2024). Other obstacles to funding climate-smart agriculture in the state include lack of access to informal financial channels, ignorance of available financing options, lack of banks and microfinance organizations, and inexperience with loan application procedures (Khan et al., 2024). Insufficient financial resources for climate-smart farming practices limit rice farmers' ability to enhance their standard of living, boost their earnings, and support the region's general economic development. Building farmer's capacity, raising awareness, bolstering financial literacy initiatives, encouraging cooperative models, investing in rural infrastructure, and creating strong connections between farmers and financial institutions are all necessary steps to address these challenges and enable climate-smart financing at the local levels.

Howbeit, most studies in Nigeria had examined the concept of climate-smart agricultural practices ranging from CSA types, adoption, use, benefits, etc. with no attention drawn to its financing mechanisms, hence the research context of the study. Juxtaposing the above scenario created a gap in knowledge and literature which the study intends to bridge by assessing the financing of climate-smart agricultural practices of rice farmers in Ebonyi State, Nigeria. Furthermore, the study contributed to knowledge and literature by projecting empirical-based evidence of financing climate-smart agricultural practices of rice farmers in Ebonyi State, Nigeria. , Hence, the research identified socio-economic features of rice farmers, climate change awareness levels of farmers; climate-smart agricultural practices of rice farmers; financing sources of climate-smart agriculture; barriers in accessing finance for climate-smart agricultural techniques; and challenges of rice farmers in rice production.

2.0 MATERIALS AND METHODS

The research took place in Ebonyi State, Nigeria. The agricultural land area of the State is 5,533 km² and located between *Latitude: 6°10'40.7028N"* and *Longitude: 7°57'33.4296E"*. The study location has 13 local government areas (LGAs) and reputed for her intensive rice cultivation with an estimated population of 3,242,500 people. The study adopted multi-stage sampling procedure in isolating the rice household farmers. At first, 4 LGAs known for intensive rice

cultivation were purposively selected from the 13 LGAs. At the second stage, 6 autonomous communities were randomly selected from each of the 4 LGAs, resulting in a total of 24 communities. The registered rice farmers in the selected communities as documented by the agricultural development programme officers were 2673. From this sample frame, 10 rice farmers were selected randomly from the 24 communities and this resulted in 240 household rice farmers. The study used questionnaire to collect primary data, which centered on the research objectives of the study. The rice farmers were properly guided in the filling of the questionnaire and this ensured full compliance to requested information. The research objectives were achieved using charts, percentage, and probit regression model.

The probit model was adopted for this study because the dependent variable is binary, representing whether or not a rice farmer accessed finance for climate-smart agricultural practices. Unlike Ordinary Least Squares (OLS) and the Linear Probability Model (LPM), which are prone to several econometric problems when applied to dichotomous outcomes, the probit model provides a more statistically robust framework (Sravanth & Sundaram, 2022, & Ismael & Duleba, 2023). The probit model ensures that all predicted probabilities fall strictly within the (0,1) interval, thereby yielding results that are both reliable and interpretable. The theoretical appeal of the probit model lies in its assumption of an underlying latent variable, representing the farmer's unobserved propensity to access finance. The model's reliance on the cumulative distribution function (CDF) of the standard normal distribution further strengthens its relevance, as it captures the non-linear relationship between explanatory variables and the probability of access to finance.

The probit regression model is shown thus

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \varepsilon_i$$

$$Y_i = \begin{cases} 1 & \text{if } Y_i > 1 \\ 0 & \text{otherwise} \end{cases}$$

Where:

Y_i = Access to finance for climate-smart practices (1 = Yes, 0 = No)

β = Estimated coefficients

X_1 = Lack of basic information

X_2 = Complicated bank application processes

X_3 = Cultural limitations

X_4 = Lack of required collateral

X_5 = Illiteracy

X_6 = Bureaucratic bottlenecks

X_7 = High interest rates

X_8 = Lack of financial institutions in rural areas

X_9 = Limited infrastructures

ε_i = error term

3.0 RESULTS AND DISCUSSION

3.1 Socio-economic Features of the Rice Farmers

The socio-economic features of the rice farmers are shown in Table 1. The reported mean age of the rice farmers was 47 years, and suggests that the farming population is largely middle-aged. This implies that most farmers are within their economically active years and this could enhance rice production and willingness to adopt innovative climate-smart agricultural practices (CSAP) (Alemayehu et al., 2024). The gender distribution of rice farmers reveals that females (57.9%) out-numbered males (42.0%), indicating that rice cultivation is female-dominated in the area. This also underscore the relevance of women in traditional agriculture competing favourably with the male folks. The lower percentage of the male could result in their involvements in other occupations which provide livelihood supports (Adeleke et al., 2024). The marital status profile of rice farmers shows that the majority are married (73.8%), while 18.8% are single and 7.5% widowed. This implies that the married ones are more involved in rice production activities. This suggests the responsibilities of the married farmers in providing for their families and dependents. Marriage is also a formidable source of labour supply in agricultural operations (Khan et al., 2024). The educational profile of rice farmers shows that 42.5% attained secondary education, 27.5% had primary education, 8.3% had tertiary education, while 20.8% had no formal education. This distribution suggests that the majority of farmers possess basic literacy, which is an advantage in agricultural farming and understanding of production techniques and operations. Basic education assist farmers in adopting climate-smart agricultural practices and loan applications (Ojiako-Chigozie, 2024). The household size distribution of rice farmers reveals that the majority (68.3%) have households of 5–8 members, while 28.8% have smaller households of 1–4 members, and only 2.9% belong to larger households of 9–12 members. The reported mean household size of 6 persons indicates the farming households are relatively large, which is typical of agrarian

communities where family labor plays a significant role in agricultural production. Family labor reduces production costs and facilitates the adoption of labor-intensive practices such as manual transplanting, and integrated weed management (Hao et al., 2025). The farm sizes among rice farmers indicates that 24.3% operate on plots of 0.1–1.0 hectares, 23.6% cultivate between 1.1–2.0 hectares, 30.9% farm 2.1–3.0 hectares, while 21.3% manage farms above 3.1 hectares. The reported mean farm size of 2.7 hectares suggests that the majority of farmers are small-to medium-scale producers, a common characteristic of rice farming in Nigeria. The mean farm size further suggests that farmers in the area are above subsistence level, implying a potential for market-oriented production (Chiaka et al., 2022). The extension contacts among rice farmers shows that 50.8% had 1–2 contacts with extension agents, 33.6% recorded 3–4 contacts, and only 15.6% had 5–6 contacts within the study period. The reported mean of 2.6 contacts indicates relatively low interaction between farmers and extension services. Extension contact plays a critical role in shaping farmers' awareness, knowledge, and willingness to adopt climate-smart agricultural practices (Maka, 2025). The results show that a significant proportion of rice farmers (78.7%) belong to cooperatives, while 21.3% do not. The high level of cooperative membership suggests that collective action plays a central role in rice farming activities in the State. This has direct implications for financing climate-smart agricultural practices, as cooperatives often serve as conduits for accessing credit, input distribution, and extension services. Moreover, cooperatives can facilitate group-based training and demonstrations, which are critical for knowledge dissemination and adoption of new practices (Mbanasor et al., 2024). The farming experience profile of rice farmers reveals that 24.3% have 1–10 years of experience, 21.3% have farmed for 11–20 years, 47.2% have 21–30 years of experience, and 7.3% have 31–40 years of experience. The reported mean farming experience of 28 years indicates that rice farmers in the State are predominantly long-term practitioners with substantial accumulated knowledge of production systems and skills that can facilitate the adoption of CSAP (Mbanasor et al., 2024).

Table 1: Socio-economic features of the rice farmers

Variable	Percentage
Age	
20-30	27.9
31-40	25.0
41-50	28.8
51& above	18.3
Mean = 47	
Gender	
Male	42.0
Female	57.9

Marital status	
Single	18.8
Married	73.8
Widowed	7.5
Level of education	
Primary	27.5
Secondary	42.5
Tertiary	8.3
Non formal	20.8
Household size	
1-4	28.8
5-8	68.3
9-12	2.9
Mean =06	
Farm Size	
0.1-1.0	24.3
1.1-2.0	23.6
2.1-3.0	30.9
3.1 & above	21.3
Mean = 2.7	
Extension contacts	
1-2	50.8
3-4	33.6
5-6	15.6
Mean = 2.6	
Cooperative membership	
Yes	78.7
No	21.3
Farming Experience	
1-10	24.3
11-20	21.3
21-30	47.2
31-40	7.3
Mean =28	

Source: Field survey data, 2024

3.2 Climate Change Awareness

Figure 1 shows the level of awareness of rice farmers to climate change. The figure revealed 97.5% of rice farmers have good knowledge of climate change, while the least group of 2.5% showed less knowledge of changing climate. The high percentage of awareness of rice farmers to climate change connotes the very prevalence of changing weather and climatic conditions ravaging the study location. It should be noted that awareness of changing climate by household farmers precedes its mitigation and possible adaptations (Sheikh et al., 2024).

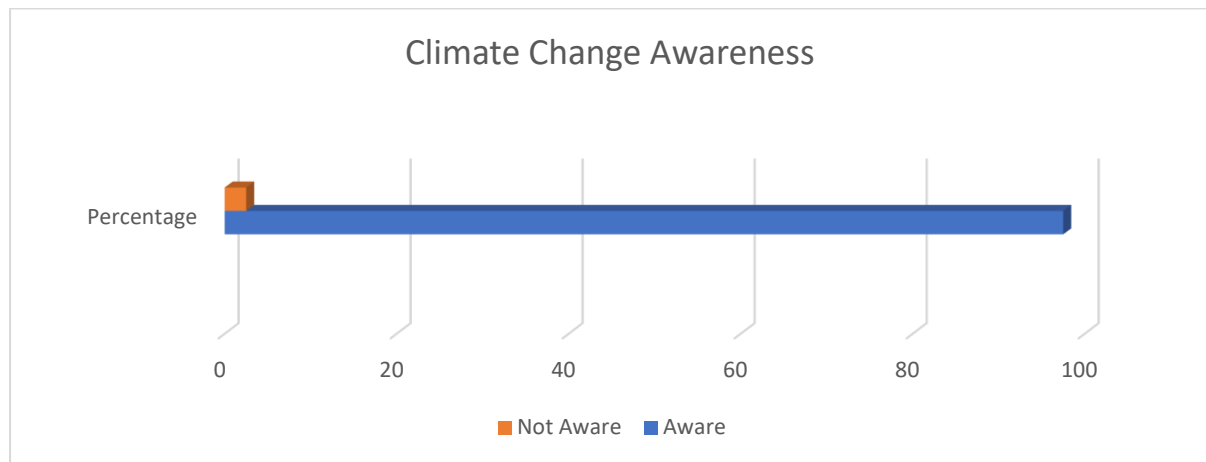


Figure 1. Climate Change Awareness. Source: Field survey data, 2024.

3.3 Climate-Smart Agricultural Practices of Rice Farmers

Table 2 shows climate-smart agricultural practices employed by rice farmers. Crop diversification was adopted by 96.2% of the rice farmers. This entails the alternative family support to avert the imminent consequences of climate change. Crop diversification ensures climate risk aversion and multiple income streams, which improves living standard of the farmers and economic livelihoods (Islam et al., 2024). Improved water management techniques were adopted by 95.0% of the farmers. This involves the practice of rain-harvesting and artificial supply of water to the rice field through irrigation means. This ensures continuous access and supply of water all-round the farming season. This helps to ameliorate rainfall irregularities and unpredictability especially during drought periods (Wang & Ren, 2025). Soil conservation practices were adopted by 94.7% of the rice farmers. This depicts the conservation of the soil via mulching, zero tillage cultivation, and soil aeration practices. Soil conservation ensures minimal destruction of the soil surface, vegetative cover, soil structure and texture. This practice improves soil-water aeration and moisture contents of the soil for all round rice cultivation. This improves rice growth and optimal yield (Johnson et al., 2024). Integrated pest management was adopted by 82.5% of the rice farmers. This entails the wholistic management of the rice field by wading-off the activities of pests and diseases which attacks rice fields. This practice helps prevent pest and disease attacks by using multiple methods ranging from cultural practices, biological, and mechanical. This results in increase in rice growth and bumper harvest of rice fields (Hajjar et al., 2023). Improved crop varieties resilient to climate change was adopted by 80.8% of the rice farmers. This climate-smart practice entails the use of only improved rice varieties and seedlings in rice cultivation. These improved and verified seedlings

are resistant to climate-induced changes and are known to perform optimally and better than indigenous rice seedlings. Improved crop varieties mature timely and adapt favorably to climatic changes (Johnson et al., 2024). Agro-forestry practices were adopted by 73.7% of the rice farmers. This entails the growing of forest trees, shrubs, etc. with rice cultivation. This practice provides shades for rice crops to grow well and at the same time shade the rice plants from adverse consequences of changing weather and climatic conditions (Saud et al., 2022). Agro-forestry ensures multiple advantages to rice farmers such as improved yields, outputs, and income. The results indicate that 70.3% of rice farmers have adopted conservation agriculture (CA). This relatively high level of adoption suggests that CA practices are gaining acceptance as viable strategies for addressing the challenges posed by climate variability and land degradation. Conservation agriculture, which emphasizes minimal soil disturbance, maintenance of soil cover, and diversification through crop rotation, has been widely promoted as a climate-smart practice capable of improving soil structure, enhancing water-use efficiency, and sustaining crop yields (Sadiq et al., 2025). The study reveals that 68.6% of farmers engage in organic farming practices, indicating a relatively strong uptake of this climate-smart agricultural (CSA) approach. Organic farming emphasizes the use of natural inputs, soil fertility management, and ecological pest control while avoiding synthetic fertilizers and pesticides. Its contribution to climate-smart agriculture is threefold: it promotes productivity, resilience, and mitigation (Mazumder, 2024). The findings show that 65.0% of rice farmers have adopted sustainable mechanization practices. This implies the practice of mechanized agricultural rice production which enhances productivity and resilience to changing climate and weather conditions. Sustainable mechanization contributes to productivity by facilitating timely land preparation, planting, and harvesting, which reduces yield losses and labor bottlenecks. In addition, mechanization enables the adoption of complementary CSA practices, such as minimum tillage, precision seeding, and efficient water management, thereby supporting long-term soil health and resource-use efficiency (Erick et al., 2025). The results reveal that 55.9% of rice farmers practiced green manuring in improving rice yields and productivity. Green manuring involves the incorporation of cover crops, such as legumes, into the soil to enhance organic matter and nutrient availability. This CSA practice improves productivity, strengthens resilience, and supports mitigation (Zheng et al., 2024). Furthermore, green manure improves soil fertility by fixing atmospheric nitrogen, enhancing soil organic carbon, and increasing nutrient cycling, which reduce reliance on synthetic fertilizers. It also improves soil structure and water-holding capacity, thereby supporting sustained crop yields

(Mazumder, 2024). In terms of resilience, the practice enhances soil biodiversity, reduces erosion, and provides a buffer against climate-induced shocks such as droughts or floods.

Table 2: Climate-smart agricultural practices of rice farmers

Climate-smart agricultural practices	Percentage
Crop diversification	96.2
Improved water management techniques	95.0
Soil conservation practices	94.7
Integrated pest management	82.5
Improved crop varieties resilient to climate change	80.8
Agro-forestry practices	73.7
Conservation agriculture	70.3
Organic farming practices	68.6
Sustainable mechanization	65.0
Green manure application	55.9

Source: Field survey data, 2024.

*Multiple Responses

3.4 Financing Sources of Climate-Smart Agriculture

Table 3 shows the sources of climate-smart agriculture financing. Personal savings was indicated by 96.5% of the rice farmers. This entails that these group of farmers sourced and financed their climate-smart agricultural practices (CSAP) via private-owned personal savings. This source of climate-smart financing is very common among local farmers who finds it difficult to access funds from other financial institutions. Personal savings averts the collateral demands of financial institutions and assists illiterate farmers who cannot cope with commercial banks paper-works (Villalba et al., 2024). Rural money lenders were indicated by 92.7% of the farmers. This entails that these percentage of rice farmers financed their climate-smart agricultural activities through commercial rural money lenders residing in the communities with the rice farmers. These money lenders give farmers credit supports with little or no interest rates and demands no collateral in return or exchange (Balana & Oyeyemi, 2022). Agricultural cooperative societies were indicated by 91.1% of the rice farmers. This entails that the farmers obtained financial supports from cooperative societies in financing their climate-smart agricultural activities. Agricultural cooperative societies are more like private money lenders who operates in unionism to assist their members and in extension to other non-members who may need their help and assistance (Gikonyo et al., 2022). They charge little interest rates to their loans which is not burdensome to the local farmers. Foreign supports

from community indigenes abroad were indicated by 80.6% of the farmers. This entails that these group of farmers accessed climate-smart financial supports from their community indigenes residing abroad who remits coordinated credits supports to their local farmers to support their farming enterprises and upturn their living standard and economic livelihoods (Ariom et al., 2022). Credit supports from political office holders was indicated by 75.5% of the farmers. This entails that these percentage of farmers financed their climate-smart agricultural practices from credit supports obtained from their political office holders who from time to time, assist the local rice farmers with financial supports and other farming incentives. Political office holders in the location offers this kind of financial services to their indigent farmers to assist them in improving their farm yield, outputs and income levels and rural farmers in the study location have benefited from these kind gestures. Local government supports were indicated by 70% of the farmers. This connotes that the farmers obtained financial supports in financing their climate-smart activities from the local government in the area. The local government offers financial supports and services to local farmers experiencing poor yields resulting from adverse climatic and weather issues. This form of support empowers local rice farmers to adopt climate-smart agricultural practices (Ma and Rahut, 2024). The findings indicate that 67.9% of farmers reported benefiting from state government interventions in relation to use of climate-smart agricultural practices. This suggests the relevance of the state governments in helping rural rice farmers finance and facilitates the use of CSAP to improve rice yields and outputs. Such interventions typically include credit guarantees, loan supports, and other financial benefits. In addition, public financing mechanisms and credit support schemes lower perceived risks for both farmers and financial institutions, making it easier to mobilize investment into CSA (Olabanji & Chitakira, 2025). The results show that 65.4% of farmers reported access to support from micro-finance institutions (MFIs). This indicates that MFIs play a substantial role in bridging the financing gap for the adoption of climate-smart agricultural practices among rice farmers. Given that smallholder farmers often lack collateral, formal credit history, and access to commercial banks, micro-finance has emerged as a critical pathway for inclusive financial access (FAO, 2024). In the context of CSA, MFIs provide small loans that enable farmers to invest in practices such as conservation agriculture, organic inputs, green manuring, and mechanization services. Access to such credit enhances productivity by financing improved inputs and technologies, supports resilience by helping farmers recover from climate shocks, and contributes to mitigation by enabling the adoption of low-emission practices (FAO, 2024). The study shows that 63.7% of farmers reported receiving support from non-governmental

organizations (NGOs) in the promotion of climate-smart agricultural practices. This indicates that NGOs constitute an important complementary actor to state and market-based mechanisms in financing and facilitating CSA adoption of rural based farmers. NGOs play a vital role in farmers-credit supports and assistances regarding adoption of CSAP (Villalba et al., 2024).

Table 3: Financing sources of climate-smart agriculture

Financing sources	Percentage
Personal savings	96.5
Rural money lenders	92.7
Agricultural cooperative societies	91.1
Foreign supports from community indigenes abroad	80.6
Credit supports from political office holders	75.5
Local government supports	70.0
State government interventions	67.9
Micro-finance institutions	65.4
NGOs	63.7

Source: Field survey data, 2024.

*Multiple Responses

3.5 Factors Influencing Access to Finance for Climate-Smart Agricultural Practices

The barriers in accessing finance for climate-smart agricultural practices are presented in Table 4. The f-ratio produced a positive significant value of 23.011 which validates the model fitness and suitability. Lack of basic information was negative and significant at 1% level. This has a negative implication for credit access and implies that the farmers lacked the basic information on sources of financial assistance and credit supports available to them. This could stem from illiteracy of the rice farmers and poor societal exposures and relationships within their environs. (Khan et al., 2024). Complicated bank application processes were negative and significant at 5% level, indicating that complicated bank application processes frustrate rice farmers efforts in accessing loan and credit facilities from commercial banks and other financial institutions. This involves the filling of many bank papers and various documentations and the complicated nature of such credit applications. This ugly and frustrating experiences dissuade several farmers from approaching bank facilities to seek for credit supports (Ariom et al., 2022). Lack of required collateral was negative and significant at 1% level, thereby compounding loan or credit applications of farmers. This implies that the farmers lack the collateral requirements requested by the financial institutions and the inability to provide such requirements may hinder access to their credit demands. Collateral demands such as lands, buildings, and security pledges worsen loans and credit requests of crop farmers (Balana et al., 2022). Illiteracy was

another barrier hindering access to credit supports and was negative and significant at 1% level. This suggest that uneducated farmers find it difficult to access loans from credit institutions, arising from their low educational status, poor exposures and ignorance. Sometimes, uneducated farmers may even be unaware of the credit facilities available at their reach and as a result misses out of such opportunities in accessing farm supports (Haryanto et al., 2023). However, in some cases, filling in the necessary papers and documents to access such loans or credit supports may be difficult for them too. Bureaucratic bottlenecks were negative and significant at 5% level, indicating a negative correlation in accessing funds for financing climate smart agricultural practices. This implies that the numerous processes and protocols involved in securing credit supports and funds for CSAP make accessing such funds frustrating and uninteresting. In most cases, crop farmers encounter unnecessary delays and difficulties in accessing credit supports (Balana & Oyeyemi, 2022). This delay is obviously worrisome and frustrating, thereby subjecting the farmers to underserved stress, pain and discouragement in seeking credit approvals. In some occasions, access to funds is hindered or delayed even when the necessary credit condition, application and documentation have been met. High interest rates were indicated by 80.7% of the farmers. High interest rates were negative and significant at 5% level; this shows the high interest rate charged by most financial institutions makes it difficult for indigent and resource-poor farmers to access credit supports in financing their climate smart agricultural practices. Generally, high interest rate discourages crop farmers in seeking agricultural credits and loan supports. This hinders large-scale investments in crop production and climate smart practices (Ma et al., 2024). Lack of financial institutions in rural areas was negative and significant at 1% level; this connotes the obvious absence of financial institutions in rural villages and communities of crop farmers. Absence of these banks make financing of climate smart agricultural practices very difficult, challenging and discouraging to crop farmers residing in rural areas. Most financial institutions are situated in urban centers and crop farmers in need of credit supports lives in rural communities, thereby making credit access difficult and tasking (Balana & Oyeyemi, 2022).

Table 4: Factors influencing access to finance for climate-smart agricultural practices

Variable	Coefficient	t-value	Std. Error
Constant	-0.7452	(-3.4326) ***	0.2170
Lack of basic information (X ₁)	-12.8933	(-4.1632) ***	3.0969
Complicated bank application processes (X ₂)	-0.6377	(-2.0054) **	0.3179
Cultural limitations (X ₃)	-0.7888	(-0.7333) ns	1.0756

Lack of required collateral (X ₄)	-0.8999	(-4.0774) ***	0.2207
Illiteracy (X ₅)	-4.7855	(-3.3691) ***	1.4204
Bureaucratic bottlenecks (X ₆)	-0.7231	(-2.5322) **	0.2855
High interest rates (X ₇)	-3.9532	(-2.3480) **	1.6836
Lack of financial institutions in rural areas (X ₈)	-0.7903	(-3.4902) ***	0.2267
Limited infrastructures (X ₉)	0.6809	(1.0701) ns	0.6363
Pseudo (R ²)	0.7801		
F- ratio	23.011***		

Source: Field survey data, 2024. Significance at **5% and ***1% levels

3.6 Challenges of Rice Farmers in Rice Production

Figure 2 shows the challenges of rice farmers in rice production. The findings of this study show that 91.7% of rice farmers identified pests and diseases as a major challenge to rice production. This very high percentage highlights the widespread and severe nature of biotic stresses in rice-based farming systems. Rice is inherently susceptible to a range of insect pests such as stem borers, brown planthoppers, and leaf folders, as well as diseases including rice blast, sheath blight, and bacterial leaf blight. These infestations can result in yield losses, thus posing a major barrier to farmers' productivity and profitability (FAO, 2024). The study revealed that 83.3% of rice farmers identified climate variability and change as a significant challenge to rice production. This high percentage reflects the growing vulnerability of rice farming systems to changing climatic conditions. Rice production is highly sensitive to climatic factors such as rainfall, temperature, and water availability. Increased variability in rainfall patterns, recurrent flooding, prolonged droughts, and rising temperatures are altering the production environment, exposing farmers to greater risks and uncertainties (Joseph et al., 2023). The results of the study indicate that 100% of the rice farmers identified high cost of inputs as a major challenge to rice production. This unanimous response underscores the severity of input-related constraints in rice farming. Key agricultural inputs such as improved seeds, fertilizers, agrochemicals, and machinery are essential for raising productivity, yet their escalating costs make them unaffordable for the majority of smallholder farmers. The situation is compounded by inflation, weak subsidy systems, and poor access to credit facilities, all of which increase the financial burden on farmers (Haryanto et al., 2023). The study revealed that 72.0% of rice farmers identified poor access to improved seed varieties as a challenge affecting their productivity. This relatively high percentage indicates that the majority of farmers face

difficulties in obtaining quality seeds that are high-yielding, pest- and disease-resistant, or tolerant to climatic stresses such as drought and flooding. Access to improved seed varieties is a critical factor in enhancing rice yields and ensuring resilience against environmental and biological stresses, yet smallholder farmers are often constrained by weak distribution systems, high seed prices, and limited awareness of available options (Olabanji & Chitakira, 2025). The findings indicate that 80.8% of rice farmers reported low mechanization as a challenge affecting their productivity. This high proportion suggests that most farmers still depend heavily on manual labor and traditional tools such as hoes and cutlasses for land preparation, planting, weeding, and harvesting. The limited availability and affordability of machinery—such as tractors, power tillers, threshers, and harvesters—contributes significantly to drudgery, low efficiency, and yield losses in rice production (FAO, 2024). The study showed that 75.0% of rice farmers identified high post-harvest losses as a significant challenge to rice production. This finding indicates that a majority of farmers face serious constraints after harvest, which reduce both the quantity and quality of rice available for consumption and sale. Post-harvest losses in rice typically occur during harvesting, drying, storage, milling, and transportation, with poor infrastructure and traditional handling methods often exacerbating the problem (Zheng et al., 2024). The study revealed that 73.8% of rice farmers identified poor access to land as a major challenge affecting rice production. Land is a fundamental resource for agricultural production, and constraints in its availability or accessibility directly limit farmers' ability to expand cultivation, adopt modern technologies, and achieve economies of scale. In many rice-producing areas, land tenure systems are characterized by fragmentation, insecurity of ownership, and restrictive inheritance practices, which reduce farmers' incentive to invest in long-term productivity-enhancing measures (Mazumder, 2024). The study revealed that 83.8% of rice farmers identified weak extension services as a major challenge affecting their production. Agricultural extension plays a critical role in disseminating information, training farmers on modern production techniques, and linking them to innovations such as improved seed varieties, integrated pest management, mechanization services, and post-harvest technologies. The high percentage recorded in this study underscores the inadequacy of extension delivery systems in meeting the needs of rice farmers (Adeleke et al., 2024).

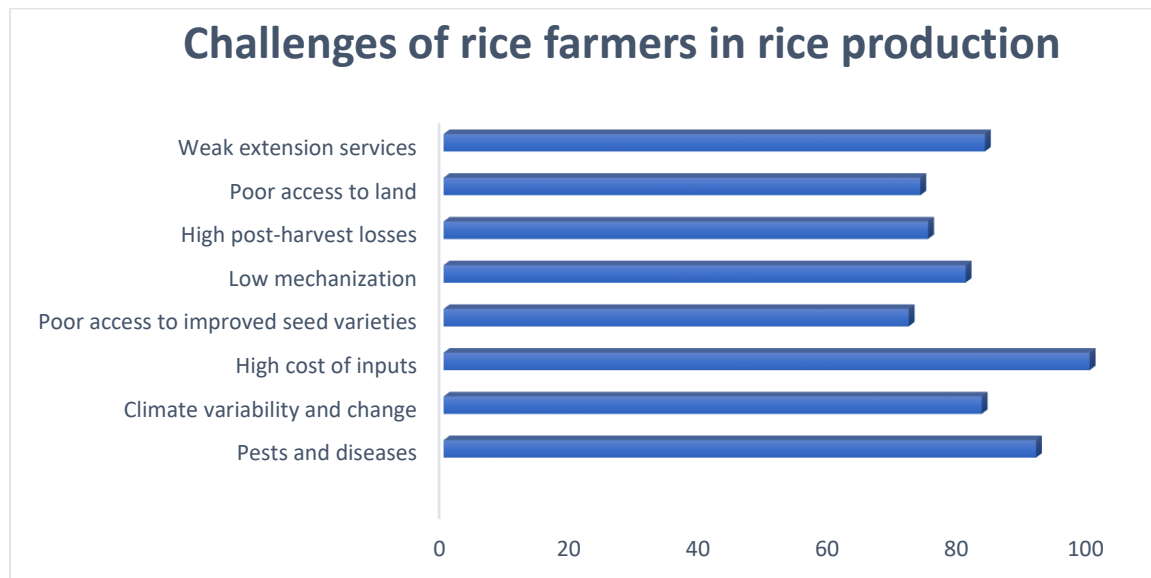


Figure 2. Challenges of rice farmers in rice production

4.0 CONCLUSION AND RECOMMENDATION

The research reveals that the rice farmers were mostly female, experienced, married, and in their productive age. Majority of the rice farmers were also aware of the changing weather and climatic conditions. The study findings reveals that most of the rice farmers engaged in climate-smart agricultural practices such as crop diversifications, improved water management techniques, soil conservation practices, integrated pest management, improved crop varieties resilient to climate change and agro-forestry practices. The rice farmers financed their climate-smart agricultural practices via personal savings, rural money lenders, agricultural cooperative societies, foreign supports from community indigenes abroad, credit supports from political office holders and local government supports. Barriers in accessing funds for climate-smart agricultural practices includes lack of basic information, complicated bank application processes, lack of required collateral, illiteracy, bureaucratic bottlenecks and high interest rates. Pests and diseases, climate variability and change, high cost of inputs, poor access to improved seed varieties, low mechanization and high post-harvest losses were major challenges encountered in rice production. The study recommends the government and other relevant stake-holders to intensify efforts in financing climate-smart agricultural practices of local farmers; this will help mitigate climate change and further improve rice production and profitability of rice farmers.

Conflict of interest

The authors declare that there is no conflict of interest.

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