ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/25sep314

The Farmers' Adoption Preference of Improved Rice Varieties in Sierra Leone (Case Study- Kambia, Pujehun & Bonthe District)

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Publication Date: 2025/09/19

Abstract: The adoption of improved rice varieties is increasingly recognized as a critical pathway toward enhancing food security, improving household income, and strengthening agricultural sustainability in developing countries. Despite widespread promotion, uptake of these varieties has remained inconsistent across farming communities. This study examines the factors influencing farmers' preferences and adoption decisions regarding improved rice varieties in Sierra Leone. Using a structured survey of rice-producing households, supported by descriptive statistics and regression analysis, the study identifies the socioeconomic, institutional, and market-related factors that shape adoption outcomes. The findings reveal that variables such as household size, education level, access to extension services, and credit availability significantly affect adoption preferences. Moreover, farmers attach considerable importance to varietal attributes such as yield potential, pest resistance, and grain quality. The results suggest that adoption strategies must align with farmers' socioeconomic conditions and cultural preferences in order to be effective. The study concludes by recommending that policymakers and development partners strengthen extension services, improve seed systems, and enhance access to credit to encourage greater adoption of improved rice varieties.

Keywords: *Adoption, Farmers' Preference, Smallholder Farmers, Food Security. Sierra Leone.*

How to Cite: Edward Yomba; Nabieu Darlington Lavalie (2025) The Farmers' Adoption Preference of Improved Rice Varieties in Sierra Leone (Case Study- Kambia, Pujehun & Bonthe District). *International Journal of Innovative Science and Research Technology*, 10(9), 922-928. https://doi.org/10.38124/ijisrt/25sep314

I. INTRODUCTION

Agriculture plays a central role in the economic and social development of Sierra Leone, where the majority of the population relies on farming for food and income. Among staple crops, rice holds a particularly important place, serving as the primary source of calories for most households. Despite its significance, domestic rice production has historically lagged behind demand, leading to continued dependence on imports to close the production-consumption gap (Chakanda, 2021). Addressing this challenge requires not only increasing productivity but also ensuring that farmers adopt improved rice varieties designed to deliver higher yields, resilience against pests and diseases, and tolerance to climatic stresses (Abebaw, Habte, Sakurai, & Alemu, 2022).

The adoption of improved agricultural technologies is often regarded as a crucial driver of rural transformation. In the case of rice, new varieties offer opportunities to boost food security, reduce poverty, and stabilize rural livelihoods. However, adoption rates remain inconsistent across Sub-Saharan Africa and, specifically, in Sierra Leone (Mansaray & Jin, 2020). While government programs and development agencies have promoted improved rice seeds, many farmers continue to cultivate traditional varieties due to cultural preferences, lack of awareness, limited access to credit, and weak extension systems (Chandio & Yuansheng, 2018). Understanding farmers' adoption preferences is therefore vital for designing effective interventions. Adoption decisions are not solely based on productivity; they also reflect household characteristics, resource constraints, institutional influences, and perceptions of risk. In Sierra Leone, where farming households operate under diverse socioeconomic and ecological conditions, identifying the specific factors that drive adoption is critical for scaling up improved technologies.

This study seeks to contribute to the growing body of literature on technology adoption by analyzing the determinants of farmers' preferences for improved rice varieties in Sierra Leone. By examining socioeconomic, institutional, and varietal factors, the research provides insights that can guide policymakers and stakeholders in designing strategies that align with farmers' needs and

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ultimately promote sustainable agricultural development. Technology adoption in agriculture refers to the process by which farmers accept, test, and incorporate new practices or crop varieties into their production systems. Rogers' *Diffusion of Innovations* theory emphasizes that adoption is influenced by factors such as the perceived advantage of the technology, compatibility with existing practices, complexity, the possibility of trial, and ease of observation within the community (Rogers, 2003). In the African context, technology adoption is often shaped by socioeconomic attributes, institutional support, and market access (Abebaw et al., 2022). Improved rice varieties are bred to deliver higher yields, resist pests and diseases, and adapt to environmental stressors including drought and flooding. They contribute to enhancing food security and reducing the reliance on imports in rice-consuming nations (Chakanda, 2021). In addition to productivity gains, these varieties may offer advantages in terms of grain quality, taste, and market value, making them attractive to both producers and consumers (Jin, Mansaray, Li, & Haoyang, 2020). Adoption outcomes are influenced by a combination of farmer characteristics and institutional settings. Age, gender, household size, and educational level are common socioeconomic factors that affect decision-making. Younger farmers are often more open to innovation, while education enhances farmers' ability to evaluate and apply new technologies (Chandio & Yuansheng, 2018). Institutional factors such as access to credit, participation in farmer groups, and the availability of extension services have also been found to play a decisive role (Abebaw et al., 2022). Additionally, the availability of markets and favorable price structures strongly motivate adoption (Maredia, 2000). Beyond yield potential, farmers frequently prioritize attributes such as taste, cooking quality, maturity period, storage performance, and resilience to pests and diseases. In Sierra Leone, local food culture strongly influences varietal selection, with some farmers continuing to cultivate traditional types despite their lower yields due to their superior flavor or milling qualities (Jin et al., 2020). Studies in Ethiopia have demonstrated that adoption of improved rice varieties improves household welfare but is uneven across regions due to differences in institutional access and farmer characteristics (Abebaw et al., 2022). In Nigeria, education, farm size, and extension support were identified as major determinants of adoption (Agricultural Society of Nigeria, 2019). In Sierra Leone, Mansaray and Jin (2020) reported that both socioeconomic factors and cultural preferences influence adoption. They noted that farmers preferred varieties that combine yield performance with desirable eating qualities.Drawing from the literature, this study applies a conceptual framework in which adoption preferences are determined by socioeconomic variables (e.g., age, household size, education, farm size), institutional factors (e.g., extension services, credit access, seed distribution), and market incentives (e.g., prices, demand). Preferences for varietal traits act as mediators between these factors and actual adoption decisions.

Despite significant efforts by government and development partners to promote improved rice technologies, adoption levels remain relatively low. Many farmers continue to cultivate traditional varieties that are often less productive and vulnerable to pests, diseases, and climatic fluctuations. This raises concerns about why adoption has been slow and what factors influence farmers' choices. Previous studies in other contexts highlight that adoption decisions are shaped not only by agronomic performance but also by household characteristics, access to extension services, credit availability, and cultural preferences (Chandio & Yuansheng, 2018). However, limited empirical evidence exists in Sierra Leone regarding the specific drivers of farmers' adoption preferences.

➢ *Objectives of The Study*

The main objective of this study is to examine the determinants of farmers' adoption preferences for improved rice varieties in Sierra Leone with special focus on the following districts (Kambia, Bonthe, & Pujehun districts).

- *The Specific Objectives Are:*

✓ To identify the socioeconomic and demographic characteristics influencing adoption decisions.
✓ To assess farmers' preferences for specific attributes of rice varieties.
✓ To analyze institutional and market-related factors affecting adoption.
✓ To provide policy recommendations for enhancing adoption rates and improving food security.

II. STUDY METHODOLOGY

➢ *Research Design*

The study is purely qualitative and exploratory since it intends to understand how farmers are able to tackle risk associated with improved varieties adoption and how it is viewed by citizens. In this endeavor, research hears the views and experience of citizens of the study area. Also we explore scientific and realistic views about key concepts of this study and see how things should be based on findings.

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/25sep314

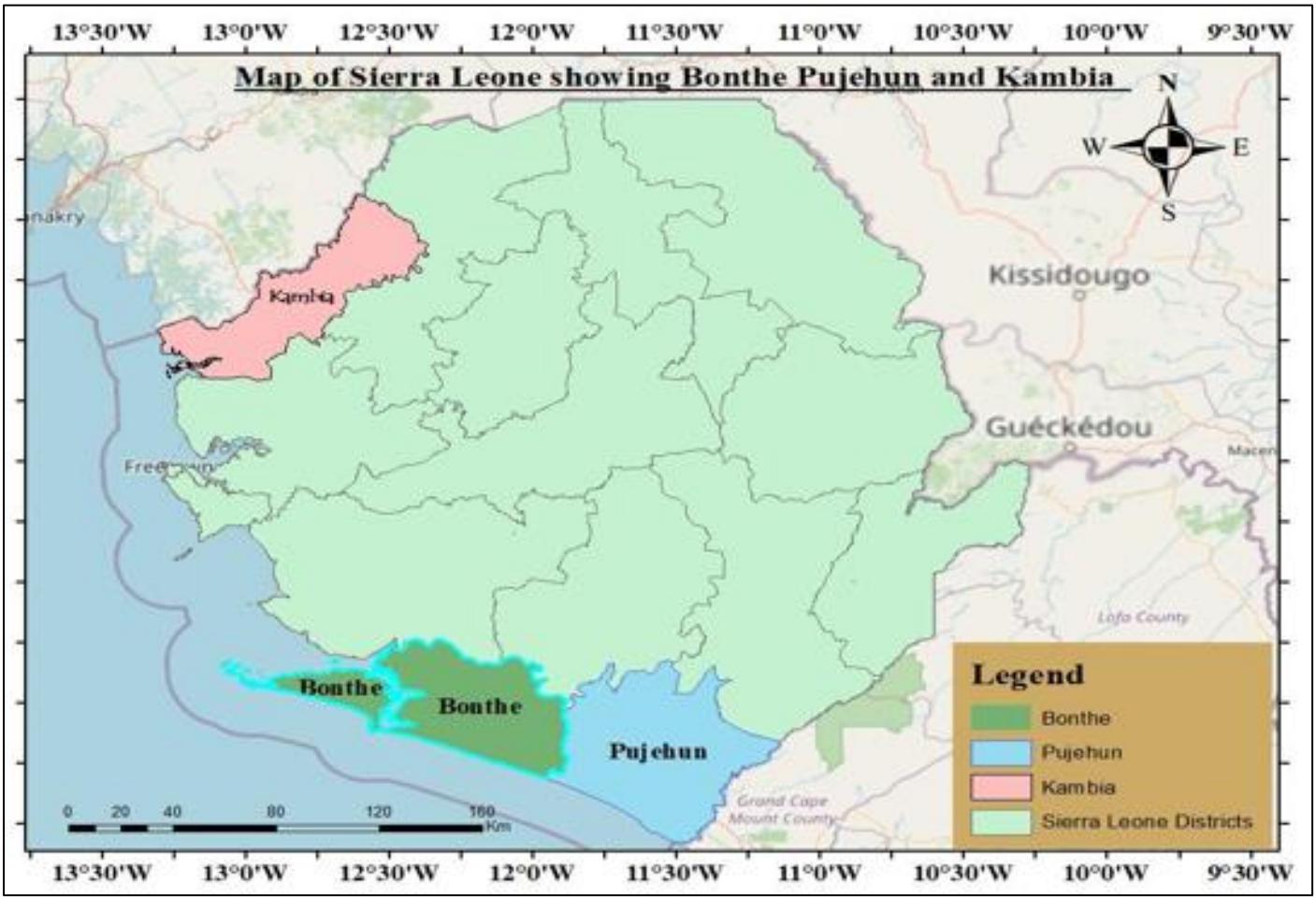

Fig 1 Sierra Leone map showing Bonthe, Pujehun, and Kambia district.

➢ *Study Area*

The study was conducted in rice-growing regions of Sierra Leone where both traditional and improved varieties are cultivated. The area was selected due to its importance in national rice production and the presence of programs promoting improved varieties.

➢ *Sampling Procedure and Sample Size*

The target population comprised rice farmers actively engaged in cultivation during the study period. A multistage sampling approach was used, beginning with the purposive selection of rice-producing districts, followed by random selection of communities and households within the following chiefdoms; Samu, Mambolo, Bum, Kabonde, Kerlu, Kpanga Krim, Masam Kpaka, Pejeh, Yo Becku and Yoni. A total of 300 households were surveyed, providing a representative sample of farmers in the study area.

➢ *Sampling Techniques*

Primary data were collected using structured questionnaires administered to household heads or key decision-makers in rice farming. The questionnaire captured demographic information, socioeconomic characteristics, institutional support, varietal preferences, and adoption status. Secondary data were obtained from government reports, academic publications, and relevant development agencies.

➢ *Data Analysis*

Data were coded and analyzed using both descriptive and econometric techniques. Descriptive statistics such as frequencies, means, and percentages were employed to summarize household characteristics and varietal preferences. To identify the determinants of adoption, regression analysis was applied. Specifically, a probit/logit model was used to estimate the probability of adopting improved rice varieties as a function of socioeconomic, institutional, and market-related variables.

III. RESULTS AND DISCUSSIONS

This section presents the study's findings and discussion in two parts: the first outlines descriptive statistics of respondents' demographic and socioeconomic characteristics, while the second interprets results from the probit regression and Kendall coefficient of concordance analyses.

➢ *Socio-demographic Characteristics of Respondents*

Socio-demographic characteristics here mean the different variables those makeup respondents'. It covers age, gender, and marital status, levels of education, religion and occupation of respondents**.**

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Table 1 Socio-Economic characteristics of farmers

Variable	Frequency	Percentage
Age		
20-30	66	22
31-40	98	32.7
41-50	74	24.7
51-60	40	13.3
60>	22	7.3
Average Age	**60**	
Gender		
Female	87	29.0
Male	213	71.0
Marital status		
Single	66	22.0
Married	213	71.0
Divorced	10	3.3
Widow/widower	11	3.7
Level of Education		
Primary	72	24.0
Secondary	44	14.7
Tertiary	9	3.0
Tech/Voc.	22	7.3
Arabic school	22	7.3
Non formal education	131	43.7
Religion		
Christian	100	33.3
Muslim	199	66.3
Traditional	1	3
Occupation		
Farming	276	92.0
Petty trade	146	48.7
Skill labor	7	2.3
Teaching	24	8.0
Mining	1	0 .3

Field Survey 2022

➢ *Age of rural rice producing farmers*

From the table above, it can be seen that; 22%, 32.7%, 24.7%, 13.3% and 7.3% respectively of the respective ages of the farmers with the mean age of 60 years. This results signifies that majority of the rice producing farmers are adults endued with lots of experience in rice farming with great amount of time in its cultivation. According to (Gong, Zimmerli, & Hoffer, 2013), they argued that older person have more farming experience than younger person.

➢ *Marital status of farmers*

It can be understood from the table above that 22% of the farmers are single, 71% married, 3.3% divorced and 3.7% being either widow or widower. The results therefore interpret that majority of the farmers are married which therefore enables most of the family members to be involved into farming related activities.

➢ *Level of education of farmers*

The results further explain that, 24% of the farmers did primary schooling, 14.7% secondary, 3% tertiary, 7.3% technical / vocational and Arabic schooling and 43.7% for non-educated farmers. The results therefore shows that majority of the farmers are not educated and that has got so many effects on farming in entirety as the world is growing rapidly into high technological farming systems that require education in some aspects. According to (Rosegrant & Cline, 2003), education has also got the tendency to improve the knowledge of farmers on new technique and technologies that will increase their productivity.

➢ *Religion of the farmers*

Regarding the religion of the farmers, it is seen that 33.3 of the contacted farmers are Christians, 66.3% are Muslims and 3% who believes in traditional religion. This result clearly shows that majority of the contacted farmers are Muslims and they constitute the major farmers network of rice farmers in the study areas.

➢ *Occupation of farmers*

As it can be seen on the table above, majority of the farmers have been engaged specifically on farming only. Most other farmers have not been only involved in farming but they have also been similarly doing off farm income generating activities in order to support their farming activities basically.

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/25sep314

- *Farmers Preference of Improved Rice Varieties Based on Crop Attributes*

The table indicates that, in terms of crop traits, farmers prioritize yield potential, time of maturity, resistance to pest and disease, and taste or palatability when selecting improved rice varieties, followed by seed rate, environmental and ecological epigenetics, and fertilizer response.

Table 2 Identifying farmer's preference on improved rice varieties based on crop attributes.

Crop Attributes	Mean Rank	Rank
Yield potential	5.68	1st
Time of maturity	6.04	2nd
Pest/disease tolerance	6.08	3rd
Taste (palatability)	6.20	4th
Seeding rate	6.43	5th
Environmental adaptability	6.53	6th
Ecology adaptability	6.66	7th
Fertilizer response	6.70	8th
Yield stability	6.8	9th
Seed price	6.81	10th
Threshing	6.84	11th
Shattering	6.87	12th
Cooking quality	7.16	13th
Test Statistics		
N	300	
Kendall's W[a]	.045	
Chi-Square (calculated)	149.762	
Degree of freedom	11	
Asymptotic significance	.000	

Field Survey Data 2022

The results revealed that beyond productivity, farmers highly valued traits such as grain quality, taste, and storability. Varieties that combined high yield with desirable eating qualities were most preferred. For example, some improved varieties were rejected because they were perceived as less palatable, even if they offered better yield. This underscores the need to integrate both agronomic and cultural factors in varietal promotion.

- *Factors affecting adoption*

Adoption levels among respondents were mixed. While a considerable number of farmers had adopted at least one improved rice variety, many continued to rely on traditional varieties. The main reasons cited for adopting improved varieties included higher yields, shorter maturity periods, and better pest resistance. Conversely, the preference for traditional varieties was driven by grain quality, cooking characteristics, and cultural familiarity.

Table 3 Factors Affecting Adoption

Variable	Coefficient.	Std. Err.	P>|z|
Marital Status	0.4568862**	0.241899	0.059
Level of education	-0.0109027	0.0557499	0.845
Religion	0.6156294***	0.2338967	0.008
Farm household size	0.2439207	0.3849736	0.526
Farm help	0.674138**	0.3893508	0.083
Livestock value	0.0002065	0.0001375	0.133
Household income	0.000336***	0.0001403	0.017
Land ownership	-0.6056774***	0.2452888	0.014
Cultivated land average	0.00325	0.0315181	0.918
No. of observation	**300**		
Wald chi2(9)	**42.27**		
Prob > chi2	**0.0006**		
Log likelihood	**-119.34427**		
Note: Dep. variable being why do you practice rice farming and represent 1%, 5% and 10% significant level			

Field survey data 2022

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/25sep314

The Regression analysis indicated that adoption decisions were significantly influenced by several variables. Education level of the household head was positively associated with adoption, highlighting the importance of awareness and knowledge in decision-making. Household size also had a positive effect, as larger households required more food and were more likely to seek higher-yielding varieties. Access to extension services emerged as a critical determinant, with farmers receiving frequent visits more likely to adopt improved rice. Access to credit significantly increased the likelihood of adoption, suggesting that liquidity constraints limit the ability of some farmers to purchase improved seeds. Gender and age also played roles, although their effects were less pronounced compared to institutional factors.

- *Challenges in the adoption of improved rice variety*

This section presents that out of 300 farmers with their specific frequencies and percentages shows that there were challenges in adoption among the parameters selected in the adoption of improved rice varieties.

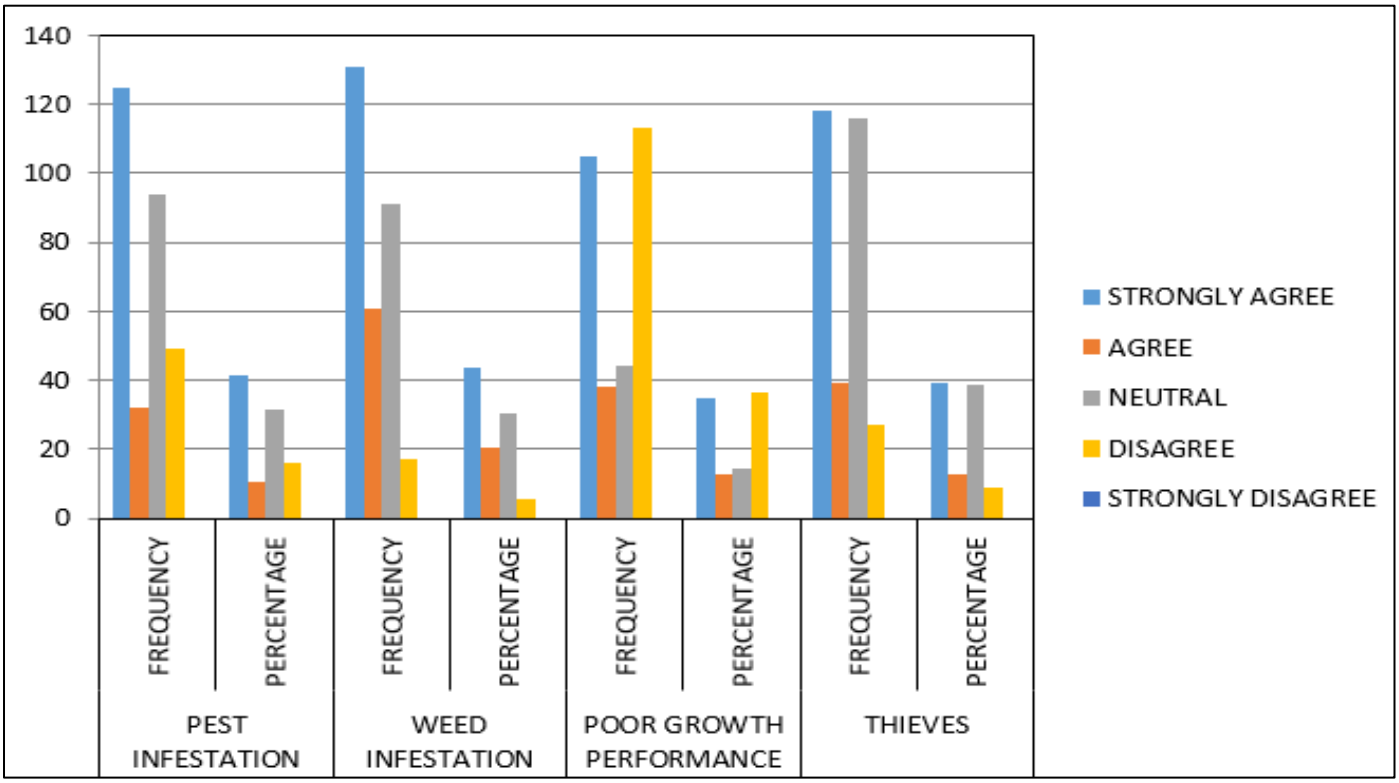

Fig 2 Challenges in The Adoption of Improved Rice Variety
Field Survey Data 2022

Weed infestation had the highest percentage (43.67%) of the strongly agreed response of the farmers on the challenges associated with the cultivation; pest infestation (41.6%), thieves (39.33%) and poor growth performance with (35%). Majority of the farmers also agreed that weed infestation has also been a major challenge in adopting improved variety. From the figure above, it is seen that none of the farmers strongly disagreed that there has not been any challenge related to any of the listed parameters related to challenges in the adopting process. It is therefore essential to consider that adopting of improved rice is required to be done effectively when improved rice varieties are cultivated simultaneously with the required pest, weeds and disease control mechanism. Thieves have not been major impediments, looking at the data on the response of the farmers and also seeds with better growth performance attributes should be introduced and used by the farmers during their cultivation exercise.

IV. CONCLUSION

The findings align with previous studies that emphasize the multifaceted nature of technology adoption in agriculture. The positive association between education and adoption is consistent with earlier research in Nigeria and Ethiopia, where education enhances farmers' capacity to evaluate and utilize improved varieties (Abebaw et al., 2022; Chandio & Yuansheng, 2018). The role of household size as a driver of adoption highlights the food security motivation, with larger households prioritizing productivity to meet consumption needs.

Institutional factors such as extension and credit support emerged as particularly important in this study. This is in line with Mansaray and Jin (2020), who observed that weak extension services and limited financial access significantly constrained adoption in Sierra Leone. Strengthening these institutional mechanisms is therefore essential for scaling up improved rice technologies.

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The results also emphasize that farmers' varietal preferences extend beyond agronomic performance. Attributes such as taste, cooking quality, and cultural acceptability were major considerations, echoing findings from Jin et al. (2020). This suggests that breeding programs and seed dissemination strategies should not only focus on yield but also take into account consumer-driven qualities that ensure acceptability among farming households.

Overall, the study demonstrates that adoption is shaped by a combination of socioeconomic characteristics, institutional arrangements, and cultural preferences. Policy interventions must therefore be holistic, addressing both the supply side (seed availability, extension support, credit) and the demand side (grain quality, cultural acceptability) to effectively enhance adoption and achieve sustainable improvements in rice production.

RECOMMENDATION

- *The Study Recommends the Following Policy Measures to Strengthen Farmers' Preferences for Cultivating Enhanced Rice Strains*

- Seed varieties that have been tested and proven suitable for the ecological conditions of Sierra Leone should be made accessible to local farmers to reduce challenges associated with the cultivation of higher-performing rice types
- Empirical results show that education has a higher chance in the adopting of rice varieties. The government and other development agencies should redouble efforts to improve education levels through training; extension services etc., in the regions since education enhances people to arrive at more informed decisions about improved rice varieties. Hence, the government and development agencies need to invest more in educational efforts.
- Farmers should be also introduced to technological systems that will enhance a robust implementation in the cultivation exercise of improved rice as that will serve as motivation in moving from traditional systems of farming to modern day farming.
- From the findings, the researcher was able to understand that men are mostly into rice farming as compared to women of which women consider it as a pain staking undertaking to cultivate rice and that the cost of production hardly merged the output cost, but with basic loans, subsidies, inputs and other means of support, will help encourage more women and men in the cultivation of rice.

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