

INFLUENCE OF COVID-19 ON RICE FARMER'S INCOME IN KWARA STATE, NIGERIA

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Abstract

The COVID-19 pandemic has had a severe impact on agricultural productivity and the livelihood of farmers in developing countries. Observed research sought to evaluate the impact of the COVID-19 lockdown on the income of rice farmers in Kwara State, Nigeria. 120 respondents were selected for this study using a multistage sampling technique. Descriptive statistics, Average treatment effects, and Likert scale were used to address the main objectives. Results showed that the COVID-19 lockdown affected the income of the rice farmers during and after the lockdown, with a 6% decrease in the income of rice farmers during the lockdown as compared to before the lockdown and a 17.7% decrease after COVID-19 lockdown as compared to during COVID-19 lockdown. Furthermore, inadequate funds, flood, and high cost of labor were found to be the highest barriers to mitigating the influence of COVID-19 on rice production. Performed study recommends that a well-structured and carefully planned response strategy be developed for situations like the COVID-19 pandemic, including the establishment of alternative income sources for farmers in the event of a future recurrence or similar crisis. Additionally, policies should be implemented to ensure adequate access to credit for rice farmers, supporting increased production and improving their overall income.

Key words: COVID-19 pandemic, farmers' income, rice production, average treatment effects.

JEL⁴: Q12, Q18, I15

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Introduction

Rice belongs to essential staple grains that feeds about half of the global population and plays a major economic role (Fahad et al., 2019). Around 480 million metric tons of milled rice are produced worldwide each year, with India and China contributing to half of the world's rice cultivation and consumption (Mohammed et al., 2019). Rice is a significant source of carbohydrates, supplying 20% of the daily caloric intake for many people and animals (Ryan, 2011). Rice also plays an economic role by providing a means of revenue for several households around the globe. Many countries in Africa and Asia rely heavily on rice for revenue for the government through foreign exchange earnings. Rice production is expected to span over 160 million hectares worldwide, yielding approximately 500 million metric tons annually (Kirby et al., 2017). Rice demand has continuously grown over the years, and currently, it plays a significant part in many nations' strategic food security planning initiatives. Rice crop output has dropped significantly in recent years, failing to keep up with population expansion. This has led to shortages and rising prices, thus affecting smallholder rice farmers negatively (Denkyirah, 2015).

In compare to whole Africa, its west parts consume the most rice, with regional demand increasing at a rate of about 6% per year. In addition, yearly per capita consumption in West Africa has increased fivefold in the previous six decades and now is the most on the continent (Arouna et al., 2021). Nigeria's per capita rice consumption is estimated at 35 kg per year, resulting in a total annual consumption of 5.2 million metric tons (Gyima Brempong et al., 2012). Rice is widely cultivated in Nigeria in all agroecological zones through various production methods, such as deep water, swampy lowlands, mangroves, and rain-fed upland (Philip et al., 2018).

Despite Nigeria's substantial rice production capacity, the rice business has been unable to meet consumer demand. Local rice farmers meet around 70% of yearly rice consumption, while rice imports meet the remaining 30%. Nigeria has become Africa's largest rice importer and the world's second-largest (FAO, 2012). The increasing demand for rice is driven by higher income levels, expanding population, and the convenience of rice processing and storage (Esiobu et al., 2020). According to Osagie (2015), Nigeria spends approximately a billion Naira (NGN) each day buying rice, a phenomenon that helps farmers find jobs in trade partner nations such as Thailand, the United States, and India while throwing Nigerian farmers out of work. The Nigerian government issued a policy decision in 2015 to restrict rice imports, which went into force in 2019. Rice farming is being supported practically across Nigeria due to the current government's goal of diversifying the economy through agro-climatic conditions and varied production methods (Esiobu et al., 2020).

While rice farmers in Nigeria are still dealing with the detrimental effects of greenhouse gas (GHG) emissions and the changing climate, the COVID-19 pandemic introduced new hazards that jeopardized the most crucial worldwide staple food crop, “Rice”, and ultimately, farmers’ livelihoods (Ankrah et al., 2021). The first human cases of the disease caused by SARS-CoV-2, which led to the COVID-19 pandemic, were initially reported by officials in Wuhan City, Hubei Province in China, in December 2019. (WHO, 2020). The total count of confirmed COVID-19 cases in Africa as of March 2nd, 2022., was 11,549,076, accounting for approximately 2.62% of all global infections. In the same period, there had been over 440.8 million coronavirus infections worldwide, resulting in almost 6 million deaths, while about 392 million persons had recuperated from the disease (Kimeli et al., 2022). Nigeria’s first confirmed COVID-19 case was reported on 27th February 2020, after one Italian citizen was tested positive in Lagos (NCDC, 2020).

In April 2021, Nigeria’s Minister of Agriculture and Rural Development established a joint technical task force to address challenges posed by COVID-19. During the lockdown, this task force facilitated the unrestricted movement of farmers, agri-food products, livestock, and agricultural inputs throughout the country, aiming to prevent food shortages and mitigate the pandemic’s impact on the cropping season (Ogisi et al., 2021). In response to reports from transporters facing challenges with moving livestock, agricultural inputs, and food during the COVID-19 lockdown restrictions, the Federal Ministry of Agriculture and Rural Development of Nigeria established a task force to address these issues (Mukaiila et al., 2024). The exemption granted for agriculture and food-related operations proved ineffective since acquiring the appropriate licenses was sometimes difficult due to office closures or limited working hours and a shortage of workers to process requests. This situation negatively affected agricultural activities during and after mentioned period (FAO, 2021).

Agricultural activities are also influenced by factors that include environmental, biological, financial, chemical, and human issues. These factors affect the timely execution of agricultural activities, and this determines to a great length the cost of production, the levels of outputs, and the profitability of the agricultural production process (Prager, Posthumus, 2010). The changing climatic conditions, coupled with other influencing factors, have become critical determinants in agricultural practices. As a result, farmers can no longer rely solely on their experience to make decisions, which affects the timely execution of agricultural activities. This delay in action often leads to increased production costs, ultimately resulting in reduced income for farmers (Gwiriri, 2012).

Rice, the most prevalent staple crop, is similarly affected, and its yield is heavily influenced by the factors described above. Every growing season, rice producers confront new challenges, such as price instability, limited rainfall, and ineffective government policies (Elbasiouny, Elbehiry, 2020). While attempting to regulate the issues influencing rice production, the novel COVID-19 pandemic posed additional obstacles to the rice value chain, which was already under severe pressure (San Juan, 2020). The COVID-19 pandemic highlighted the interconnectedness between health and food systems, including the linkage between local and global food systems. Lockdowns and border restrictions impacted local and national agricultural input, output, and food markets, leading to substantial losses in the global total economic output. These disruptions heightened the vulnerability of agri-food systems and rural livelihoods in impoverished nations (FAO, 2021).

The COVID-19 pandemic affected the operations and sales of rice, and this in turn affected the profitability of rice farmers, with most effects felt by the small-scale rice farmers in rural areas. The disruptions caused by the pandemic pose a significant danger to the livelihoods of rice farmers and the nation's food and nutritional security (Tansuchat et al., 2022). A few related studies have explored the impact of COVID-19 on rice farming (Esiobu, 2020; Hasanah et al., 2021; Schmidt et al., 2021). However, none of these studies have directly connected the perceived effects of the pandemic to a quantitative assessment of rice harvests. This study aims to address this gap. The primary objective is to examine the impact of the COVID-19 lockdown on the income of rice farmers in Kwara State, Nigeria. More specific, study describes the main sociodemographic features of rice farmers, identifies their information sources and the precautionary measures they adopted during the pandemic, evaluates the observed effects of COVID-19 on rice yields and market prices, and identifies the challenges faced in mitigating the pandemic's impact on rice farming.

Literature Review

Theoretical framework: Theory of income

Firms create the majority of the economy's production. They generate the whole number of final products and sell them on the goods market. The whole value of these final items equals the total revenue of the economy, which represents the inflow of money to the business sector. In agriculture, the farm produces agricultural commodities that are sold for income (Asimakopulos, 2012). "In the four-sector model, income flows between enterprises, households, the government, and the rest of the world, and these flows pass through the goods and capital (financial) markets,

as well as occasionally from one sector directly to the other. The goods market is the market for final goods and services for consumption (excluding intermediate products but including investment goods)", (Ahern, 2013). Income is generated from the outputs of the production process. In agriculture, production is the process of combining resources such as land, labor, capital, and management to produce output (Kamaludin et al., 2021). Production can be represented as:

$$Q = f(X) \quad (1)$$

Where, Q = quantity of outputs, X = inputs (i.e. factors of production), and f = relationship between Q and X, while the total value of Q (produce) gives the total income in an economy.

Related empirical studies

Very few studies have been done to examine the impact of COVID-19 on rice production. Esiobu (2020) underlined that current dangers from the COVID-19 pandemic are posing additional obstacles to the rice value chain, which already had been under intense pressure. Farmers were urged to respond swiftly to the challenges posed by the pandemic by adopting yield-enhancing techniques. However, at the time of this study, no empirical data was available on the direct impact of the COVID-19 pandemic on rice output. Schmidt et al. (2021) investigated the effects of COVID-19-related income and rice price shocks on the welfare of households in Papua New Guinea. Their model simulations suggested that a 25% rise in global rice prices would result in a 14% decrease in overall rice consumption in the country, with a 15% reduction specifically among poorer households. Additionally, in the context of a projected 12% decline in household income due to the economic downturn caused by COVID-19, rice consumption among impoverished households decreased by 20% in urban areas and 17% in rural areas. Hasanah et al. (2021) investigated the influence of COVID-19 on rice farmers' household food security in Indonesia. The purchasing power of farmer families and the income exchange rate were used to calculate the degree of welfare of farmer households. They discovered that COVID-19 had a detrimental influence on farmers' revenue. The degree of food security of farmer households was also significantly impacted as the number of food-insecure households rose. Abdul (2020) discovered that the economy suffered more severe impacts as the number of lockdown days and restrictions on inter-state and cross-country movement increased. This subsequently led to situations such as increased postharvest loss, increased food prices, high transport costs, low purchasing power by households, hoardings by marketers, etc., all of which had an adverse effect on food security.

Materials and Method

Study area

Kwara State is situated in the West-Central region of Nigeria, within the area known as the Middle Belt. The state spans between longitudes 2°30'30 E and 6°25' E and latitudes 7°45' N and 9°30' N, covering an area of approximately 32,825 square kilometers. Established in 1967, Kwara State consists of 16 Local Government Areas and has a population of around 2.37 million (NPC, 2006). It shares an international border with the Republic of Benin and is bordered by Oyo, Niger, Kogi, and Osun states within Nigeria. Agriculture is the primary occupation of its residents, with key crops such as rice, maize, beans, sweet potatoes, sorghum, and yam serving both as food staples and cash crops. The state experiences two distinct climate seasons (wet and dry) and features natural vegetation ranging from rainforests to wooded savannahs. The average temperature ranges from 30°C to 35°C, with annual rainfall levels between 1,000 mm and 1,500 mm.

Sampling techniques

The research was employed a three-stage sampling technique. During the first stage, two Local Government Areas (LGAs) out of the sixteen in Kwara State (Patigi and Edu) were purposively selected due to their prominence as the main rice-producing areas within the state. Next stage involved the purposive selection of six villages from each of these two LGAs. In the final stage, 10 rice farmers were randomly selected from each village for interviews, resulting in a total sample size of 120 respondents. The sample is representative of the study population as it purposively includes major rice-producing Local Government Areas (LGAs) in Kwara State. More precisely, it ensures that the selected 120 rice farmers reflect the average characteristics and experiences of those most impacted by the COVID-19 pandemic in this key agricultural region.

Data collection

Primary data was gathered using structured questionnaires, supplemented with interviews for respondents who were unable to read or write, conducted at suitable locations. The questionnaire was segregated into different sections and designed such that each objective was assigned a section to acquire information specifically on the intended objective.

Data analysis

Through the questionnaires collected data have been analyzed using the few methods.

Descriptive analysis

Descriptive statistics, including percentages, means, and frequencies, were utilized to describe the sociodemographic characteristics of the rice farmers, determine the source of information, and the precautionary measures farmers practiced during the COVID-19 pandemic.

Average treatment effect

The Average Treatment Effect (ATE) was used to estimate the difference in income levels of rice farmers before, during, and after the COVID-19 lockdown. To ensure accurate estimation and to account for potential biases, the study employed the Inverse Probability Weighted (IPW) regression adjustment of the treatment-effect model. This method adjusts for selection bias by assigning weights to individuals based on the inverse probability of receiving the treatment (e.g. being impacted by the lockdown). The IPW approach allows for a balanced comparison between treated (affected during the lockdown) and untreated (unaffected before lockdown) groups, thus providing a more reliable estimate of the impact of the COVID-19 lockdown on the rice farmers' income. ATE estimates derived through this approach help quantify the economic effects of the lockdown on rice production activities, capturing both immediate and residual impacts on farmers' livelihoods.

$$ATE (\Delta I) = Y_{i1} - Y_{i0} \quad (2)$$

Where, Y_{i1} denotes income during and after COVID-19, Y_{i0} denotes income before COVID-19

Likert - Scale

A five-point Likert Scale was used to identify the barriers to mitigating COVID-19 pandemic effects in production, while 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. Data collected using the Likert Scale were used to calculate the mean score.

Study limitations

The study's reliance on self-reported data from rice farmers may introduce recall bias, particularly regarding income and production levels during the COVID-19 lockdown. Additionally, the use of purposive sampling from only two rice-producing LGAs may limit the generalizability of the findings to all farmers in Kwara State. However, the insights gained are valuable for understanding localized challenges and guiding policymakers in developing resilient agricultural support systems for future crises.

Results and Discussion

Socioeconomic characteristics of respondents

Results show that almost all (96.67%) of the respondents were males (Table 1.). This finding probably indicates that rice farming activity is an energy-demanding work, with the females more involved in post-harvest operations like drying, threshing, cleaning, etc. This result is in consonant with the findings of Mafimisebi and Ikuerowo (2018), who noted that rice cultivation and marketing are predominantly carried out by males, likely due to the physically demanding nature of the work involved, which is suited to the more energetic nature of the male gender. Most (41.67%) of the rice farmers were up to 30 years old (mean age of the respondents was 36.66). This indicates that the farmers in the study area are young, energetic, and capable of utilizing their resources effectively. These findings are consistent with those of Matanmi et al. (2011), who observed that most individuals engaged in rice production belong to the middle age group, characterized by high energy and productivity. Additionally, most (75.83%) of the respondents were married, suggesting that a significant portion of them had access to family labor, which helped to offset the shortage of hired labor during the COVID-19 pandemic. This observation is in line with Esiobu (2020), who found that married farmers are more likely to adapt to the effects of the COVID-19 pandemic compared to their unmarried counterparts, due to their access to family labor.

Furthermore, a significant share of respondents (49.17%) had attained tertiary education, while nearly 15% had no formal education. Approximately 75% of the respondents had some level of education, which likely enhanced their understanding of the COVID-19 pandemic, its impact on rice production activities, and the various strategies for mitigating its effects on rice production.

Table 1. The Socio-demographic features of respondents (N = 120)

Variables	Frequency	Percent	Mean
Gender			
Female	4	3.33	
Male	116	96.67	
Age			
≤ 30	50	41.67	36.6
31 – 40	30	25.00	
41 – 50	29	24.17	
51 – 60	7	5.83	
Above 60	4	3.33	
Marital Status			
Single	24	20.00	
Married	91	75.83	

Variables	Frequency	Percent	Mean
Divorced	3	2.50	
Widowed	2	1.67	
Education Level			
No Formal Education	18	15.00	
Primary	18	15.00	
Secondary	25	20.83	
Tertiary	59	49.17	
Household Size (members)			
≤ 5	16	13.33	10
6 – 10	68	56.67	
Above 10	36	30.00	
Farming Experience			
≤ 5	7	5.83	18
6 – 15	58	48.33	
16 – 25	35	29.17	
26 – 35	12	10.00	
Above 35	8	6.67	
Land Ownership			
Owned	90	75.00	
Rent	24	20.00	
Borrowed	6	5.00	
Farm size (ha)			
≤ 5	88	73.33	4.36
6 – 10	28	23.33	
Above 10	4	3.33	
Access to Credit			
Yes	86	71.67	
No	34	28.33	
Farm Income			
≤ 50,000	1	0.83	439,916
50,000 – 100,000	18	15.00	
101,000 – 200,000	23	19.17	
201,000 – 300,000	19	15.83	
Above 300,000	59	49.17	

Source: Belewu et al., 2021.

The majority of respondents (56.67%) had a household size of 6 to 10 members, with approximately 86.67% having more than 5 family members. The average household size was 10, indicating that many farms rely on a substantial number of family members, which contributes significantly to the overall labor capacity of the farms. This capacity is sufficient to offset any reduction in hired labor caused by the COVID-19 pandemic. These findings are consistent with those of Mafimisebi and Ikuerowo (2018), who reported that when the majority (62%) of households consist of 6 to 10 members, farmers are often able to involve their household members in rice

production and marketing activities. Results further showed that 75% of respondents owned the farmland used in their farming.

Most of the respondents had farms in size of less than 5 ha, or in average farm size was 4.36 ha. This conforms with the findings of Matanmi et al. (2011), who reported that the majority of the respondents (approximately 72.7%) had farms in sizes of slightly less than 5 ha. Results also show that the most of farmers (48.33%) had a farming experience of 6-15 years, or on average 18 years, implying that farmers are well experienced, while had been in the farming business for a certain period before COVID-19. They could be experienced enough to control and manage risks and uncertainties in rice production.

Results further revealed that nearly half of respondents (49.17%) earned in average seasonal income of over than 300,000 NGN (around 380 USD), with the average annual farm income amounting to 439,916 NGN (approximately 558 USD). Besides, most of the respondents (68.33%) were primarily engaged in farming, so for most of them the major source of income is farming. This result is in consonant with the findings of Khattak and Hussain (2008), where the majority of respondents had farming as their major occupation. Also, the most of respondents did not have access to credit, possibly making it difficult to mitigate the effects of COVID-19 on rice farming due to a lack of available funds. Denkyirah et al. (2016) reported that the majority of rice farmers in Ghana had access to credit from family members and used the credits on non-agricultural activities.

Farmer's source of information and precautionary measures during COVID-19

The presented results show the main sources of information on the COVID-19 pandemic among rice farmers in the study area (Table 2.). It reveals that 31.67% of respondents used radio sets as the primary source of information, 30.38% used television as a source of information, 20% of respondents sourced information via SMS through mobile phones, and 16.67% of them sourced information through family and friends, and 0.83% of respondents obtained information through extension agents. Extension service, which should have kept farmers well informed about the impact of the COVID-19 pandemic, as well as various ways to mitigate the risks and curb its impacts, was lacking in the study area.

In terms of farmers' health precautionary measures during the COVID-19 pandemic, the result shows that 95.83% of the respondents used facemasks, 62.50% of the farmers practiced no handshaking, while 51.67% of them practiced social distancing, or 39.17% of respondents practiced healthy feeding in efforts to control the spread of the COVID-19.

Table 2. Farmer's source of information and precautionary measures during the COVID-19 pandemic.

Variables	Frequency (N = 120)	Share
Source of Information		
Extension agent	1	0.83
Friends and family	20	16.67
Radio set	38	31.67
Television	37	30.83
SMS	24	20.00
Farmers' Precautionary Measures		
Use of Facemask (Yes)	115	95.83
No Handshaking (Yes)	75	62.50
Social Distancing (Yes)	62	51.67
Healthy Feeding (Yes)	47	39.17

Source: Belewu et al., 2021.

Effects of COVID-19 on rice farmer's income during and after lockdown

The results presented in Table 3. explain the impact of the COVID-19 lockdown on the income level of farmers during and after the lockdown. Using the Inverse Probability Weighted (IPW) regression adjustment of the average treatment-effect model, the study addressed potential selection biases, particularly those arising from non-compliance, by adjusting for differences in observable characteristics between treated and untreated groups. The Average Treatment Effect (ATE) on the sub-population before lockdown was 6%. This implies that the respondents had a 6% increase in their income before lockdown than in the period of lockdown. This could translate to a significant impact of the lockdown on the income of the respondents during the COVID-19 outbreak. The ATE on the sub-population after lockdown was negative 17.7%. This implies that the respondents had a 17.7% decrease in their income after lockdown than in the period of lockdown. This suggests that the lockdown had a significant impact on the respondents' income, as well as on rice production activities after the lockdown. The disruption could be attributed to the residual effects of the various measures implemented to combat COVID-19. Additionally, the inability of farmers to quickly adjust to these challenges likely had a substantial impact on the subsequent rice production season.

The gained results (Table 3.) also showed that possible outcomes (PO) means for "0" before the lockdown is 0.276 (p -value < 0.01), indicating a highly significant mean outcome in the absence of treatment before the lockdown. This implies that the baseline conditions (without intervention or treatment) for rice producers were statistically robust and relatively favorable before the lockdown. After the lockdown, the PO means for "0" drops to 0.243 (p -value < 0.01) which is still statistically

significant but indicating a decrease from the pre-lockdown baseline. This shift might be indicative of the broader economic or operational challenges that rice producers faced during the lockdown period, likely linked to restrictions on movement, supply chain disruptions, or reduced access to markets.

Table 3. Inverse Probability Weighted (IPW) regression adjustment of the ATE model estimation

Variables	Coefficient	Z	P > Z
Before Lockdown			
ATE			
I vs 0	0.060*	1.63	0.103
PO means			
0	0.276***	5.62	0.000
After Lockdown			
ATE			
I vs 0	-0.178*	-1.77	0.076
PO means			
0	0.243***	3.96	0.000

Source: Belewu et al., 2021.

Note: *** and *represents 1% and 10% significance levels respectively.

Barriers to mitigate the effects of COVID-19 pandemic on rice production

Results presented in Table 4. reveal the barriers faced by farmers in mitigating the impact of the COVID-19 pandemic on rice production using the Likert type scale. Inadequate fund was ranked as the first barrier with a mean score of 4.33. This was likely because it directly constrained farmers' ability to purchase inputs, invest in recovery strategies, and manage increased production costs during and after the pandemic. Flood (mean score 4.29) is being with the second highest score, suggesting that environmental factors exacerbated the challenges of the pandemic, possibly due to farmers' reduced capacity to cope with these events during a time of economic hardship.

Table 4. Barriers to mitigating the effect of COVID-19 pandemic on rice farmer's income

Variables	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree	Mean Score	Rank
	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)		
Inadequate Funds	58 (48.33)	50 (41.67)	6 (5.00)	6 (5.00)	0 (0.00)	4.33	1st
Flood	62 (51.67)	43 (35.83)	6 (5.00)	6 (5.00)	3 (2.50)	4.29	2nd
High Cost of Labor	58 (48.33)	39 (32.50)	16 (13.33)	6 (5.00)	1 (0.83)	4.23	3rd
Inadequate Information	54 (45.00)	49 (40.83)	4 (3.33)	12 (10.00)	1 (0.83)	4.19	4th
Poor Production	63 (52.50)	29 (24.17)	9 (7.50)	11 (9.17)	8 (6.67)	4.07	5th

Variables	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree	Mean Score	Rank
	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)		
Theft	47 (39.17)	45 (37.50)	13 (10.83)	11 (9.17)	4 (3.33)	4.00	6th
Poor Access to Credit	41 (34.17)	52 (43.33)	12 (10.00)	12 (10.00)	3 (2.50)	3.97	7th
Lack of Trust in Government	47 (39.17)	43 (35.83)	11 (9.17)	15 (12.50)	4 (3.33)	3.95	8th
Distance to Market	40 (33.33)	44 (36.67)	14 (11.67)	13 (10.83)	9 (7.50)	3.78	9th
Poor Extension Contact	35 (29.41)	32 (26.89)	21 (17.65)	24 (20.17)	8 (5.88)	3.52	10th
No Covid-19 Palliative	27 (22.50)	23 (19.17)	26 (21.67)	30 (25.00)	14 (11.67)	3.16	11th

Source: Belewu et al., 2021.

The high cost of labor (mean score 4.23) ranking as third, highlights the labor shortages and increased wage demands during the pandemic, likely due to restrictions on movement and the reduced availability of workers. Inadequate information had a mean score of 4.19, poor production had a mean score of 4.07, theft had a mean score of 4.00, poor access to credit had a mean score of 3.97, lack of trust in the government had a mean score of 3.95, distance to market had a mean score of 3.78, poor extension contacts had a mean score of 3.52, while no COVID-19 palliative had a mean score of 3.16. These constraints left the farmers unable to fully mitigate the effects of the COVID-19 pandemic on sustainable rice production in the study area. These rankings collectively suggest that financial and environmental constraints, compounded by increased operational costs, were perceived as the most significant obstacles to resilience and recovery among rice farmers in the study area.

Conclusion and Recommendation

According to performed study, it can be concluded that the major sources of information for farmers during COVID-19 were radio and television. There came a significant decrease in the income of rice farmers in the observed area during the COVID-19 lockdown, as well as a larger decrease in the following cropping season which could be attributed to the impact of COVID-19 on rice production and subsequent income of rice farmers. Several factors posed a barrier to mitigating the impact of COVID-19 on rice production, such are inadequate funds, flood, and high cost of labor, amongst others.

Based on the main findings, it is recommended that the government, agricultural agencies, NGOs, and certain financial institutions support farmers with easily accessible credit and input facilities at subsidized rates. This will largely improve rice production and, subsequently, the income of rice farmers since inadequate funds remain the largest barrier to mitigating the impact of COVID-19 in Kwara State. The government should implement adequate planning and establish effective

response strategies to prepare for future pandemics or unexpected natural events that could significantly impact rice production and farmers' incomes. Additionally, farmers should receive training and education from extension agents on enhancing production, marketing, and sales of agricultural products to maximize income, as well as on strategies to respond effectively to unforeseen disruptions.

Future research could explore the long-term recovery trajectories of rice farmers and other crop producers post-COVID-19, focusing on the effectiveness of policy interventions and adaptive strategies in improving resilience and restoring income levels in rural agricultural communities.

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