



Climate Variability Adaptation Strategies among Rice Farmers in Niger State, Nigeria

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ABSTRACT

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This study assessed the climate variability adaptation strategies among the rice farmers in Niger State, Nigeria. A two-stage sampling procedure was used in the selection of 248 respondents from the list of rice farmers obtained from Rice Farmer Association of Nigeria (RIFAN), Niger State. The adjusting of planting and harvesting dates (M.S = 3.77) was the highest ranked adaption strategy to climate variability. The increase in quality of rice produced (M.S = 4.48) was the highest ranked perceived benefit of usage of climate adaptation strategies. The determinant factors of usage of climate adaptation strategies were rice farmers' educational level ($t = 1.729$), household size ($t = -0.197$) and farm size ($t = 0.372$, p) at 5% level of significance. The study therefore recommends that the rice farmers should adopt main adaptation strategies such as adjusting the planting and harvesting dates, application of traditional irrigation agriculture and livelihoods diversification in order to improve their rice outputs, income and food security.

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INTRODUCTION

Climate variability is an emerging challenge limiting food production and livelihoods of many people in developing countries of the world (Allen et al., 2014; Abdulrahman et al., 2023). Climate variability refers to climatic parameters of a region varying over a short-term mean (Abuo et al., 2023). Climate variability is one of the greatest challenges limiting food production and food security in developing countries like Nigeria (Olooto et al., 2018; Abdulrahman et al., 2021; Ifabiyi et al., 2022). Climate

variability is gradually becoming a universal phenomenon (Abdallah et al., 2019; Hundera et al., 2019; Portner et al., 2022). However, poor and developing nations of the world were most negatively affected due to lack of funds and facilities for adaptation and mitigation against it (Njeru et al., 2016; Morton, 2007). The negative effects of climate variability are severely felt by the poor people who depends on the agriculture and the environment for their livelihoods (World Bank, 2010; Olooto et al., 2022; Ifabiyi et al., 2023). Nigeria have been reported to be among the “highly vulnerable” countries to climate variability in the world (World Bank Group, 2019). Also, Babatunde (2022) stated that Nigeria have been reported to be the 55th most vulnerable country to climate variability and 22nd least ready to combat climate variability in the world. High levels of poverty, food insecurity, and low productivity in Sub- Saharan Africa, including Nigeria are largely driven by low levels of agricultural technology adoption and Climate variability-related impacts (Stuch et al., 2021).

Adaptive strategies in climate variability are measures that are aimed at responding to climate variability and limiting its negative effects. Adaptation measures are methods aimed at adjusting to climate variability (FAO, 2021). The Intergovernmental Panel on Climate Change (IPCC, 2001) states that climate variability adaptation strategies are the methods or processes of adjusting to climatic stimuli in order to build resilience. Farmers must respond to climate variability and find ways to cushion its negative effects (Alam et al., 2013). The Rice Farmers have used several climate variability adaptation measures such as adjustment of planting dates, zero or minimum tillage, application of manures, mixed farming, planting of improved seed varieties and diversification of livelihoods (Teklewold et al., 2019).

According to Saud et al. (2022), rice is one of the most climate-sensitive crop in the world. Studies on adaptation to climate variability among rice farmers is important as rice is an important staple food in Nigeria, and also to ensure there is sustainable and continuous production of rice in the country (Abdulrahman, 2023). Also, there is scarcity of information on the adaptation strategies to climate variability in the study area. This established the lacuna that this study sought to fill. Hence, there is a need to assess the Climate variability Adaption Strategies among the rice farmers in Niger State, Nigeria. The specific objectives were to:

- 1) Determine the Climate variability adaptation strategies of the respondents in the study area.
- 2) Assess the perceived benefits of adaptation strategies against climate variability used by the respondents in the study area
- 3) Identify the Determinant Factors of Climate Adaptation Strategies used by the respondents in the study area.

MATERIALS and METHODS

This study was carried out in Niger States, Nigeria. Niger State, Nigeria is situated in the north-central geo-political zone, along the Middle Belt region of Nigeria. Niger State has a population of 3.9 million people. A 2-stage sampling procedure was employed in this study. The first stage involved a purposive selection of 3 Local Government Areas from each of the three agro-political zones in Niger State with high rice production rate. The second stage involved a random selection of 8% of the total population of registered Rice Farmers Association of Nigeria (RIFAN) members in the selected LGAs making a total of 248 respondents. To measure the Climate adaptation strategies, a 4-Point Likert-Type Scale was used where Never Used (N.U) = 1; Rarely Used (R.U) = 2; Often Used (O.U) = 3; and Always Used (A.U) = 4. To measure the perceived benefits of adaption strategies against climate variability, a 5-Point Likert Scale was used where Strongly Agree (S.A) = 5, Agree (A) = 4, Undecided (U) = 3, Disagree (D) = 2 and Strongly Disagree (S.D) = 1.

Statistical Analysis

To determine the determinant factors of climate strategies, a multiple regression analysis was used, which utilized a method called ordinary least squares (OLS) to determine the coefficients. The use of OLS is based on its proven adequacy in situations when there is the need to predict the value of a variable (the dependent variable) (Berger, 2003). The statistical tools used to analysed the data were frequency count, mean and percentages.

RESULTS and DISCUSSION

Climate Adaptation Strategies Used by the Rice Farmers

The result in Table 1 showed that adjusting planting and harvesting dates (M.S = 3.77) was the highest ranked adaptation strategy to climate variability. The application of traditional irrigation agriculture (M.S = 3.46) and livelihood diversification (M.S = 3.39) were ranked second and third respectively. This result denotes that adjusting planting and harvesting dates, application of traditional irrigation agriculture and diversification of livelihoods were the most important climate variability adaptation strategies used by the respondents in the study area. This finding agrees with the works of Obot and Obiekwe (2022) which revealed that adjustment of planting dates is a major strategy for adapting to climate variability.

Table 1. Climate adaptation strategies employed by rice farmers (n=248)

Adaptation Strategies	N.UF (%)	R.UF (%)	O.UF (%)	A.UF (%)	M.S	Rank
Adjusting planting and harvesting dates	4 (1.6)	9 (3.6)	28 (11.3)	207 (83.5)	3.77	1 st
Application of traditional irrigation agriculture	10 (4.0)	10 (4.0)	85 (34.3)	143 (57.7)	3.46	2 nd
Livelihood diversification	8 (3.2)	9 (3.6)	110 (44.4)	121 (48.8)	3.39	3 rd
Migration to other areas for planting	9 (3.6)	11 (4.4)	129 (52.0)	99 (39.9)	3.28	4 th
Using different agrochemicals (pesticides and herbicides)	5 (2.0)	8 (3.2)	169 (68.1)	66 (26.6)	3.19	5 th
Increased application of chemical fertilizers	7 (2.8)	63 (25.4)	86 (34.7)	92 (37.1)	3.06	6 th
Planting drought tolerant variety	7 (2.8)	88 (35.5)	73 (29.4)	80 (32.3)	2.91	7 th
Mulching to conserve soil moisture	6 (2.4)	95 (38.3)	145 (58.5)	2 (.8)	2.58	8 th
Using improved rice varieties	6 (2.4)	128 (51.6)	113 (45.6)	1 (.4)	2.44	9 th
Use of prayer (Praying)	41 (16.5)	90 (36.3)	114 (46.0)	3 (1.2)	2.32	10 th
Drainage construction/flood barriers	84 (33.9)	155 (62.5)	6 (2.4)	3 (1.2)	1.71	11 th
Resort to mixed farming (local crop and livestock)	116 (46.8)	123 (49.6)	5 (2.0)	4 (1.6)	1.58	12 th
Seeking weather forecasting information	175 (70.6)	62 (25.0)	5 (2.0)	6 (2.4)	1.36	13 th
Planting on nursery beds	200 (80.6)	37 (14.9)	6 (2.4)	5 (2.0)	1.26	14 th
No adaptation	214 (86.3)	24 (9.7)	4 (1.6)	6 (2.4)	1.20	15 th

Source: Field Survey, 2023 N.U = Never Used; R.U = Rarely Used; O.U = Often Used; A.U = Always Used; M.S = Mean Score

Perceived Benefits of the Climate Adaptation Strategies

The result in Table 2 revealed that increase in quality of rice produced (M.S = 4.48) was the highest ranked perceived benefit of usage of climate adaptation strategies. Reduction of crop losses (M.S = 4.29) and increase in rice yield (M.S = 3.77) was ranked second and third respectively. This result shows that increase in quality of rice produced, reduction of crop losses and increase in rice yield were the most important benefits of climate adaption strategies in the study area. This finding is in line with Onyeneke (2021) who stated that the adoption of climate adaption strategies led to increase in rice output.

Table 2. Perceived benefits of the climate adaptation strategies used by rice farmers (n=248)

Perceived Benefits	S.DF (%)	DF (%)	UF (%)	AF (%)	S.AF (%)	M.S	Rank
Increase in quality of rice produced	7 (2.8)	2 (.8)	1 (.4)	92 (37.1)	146 (58.9)	4.48	1 st
Ability to reduce crop losses	3 (1.2)	8 (3.2)	7 (2.8)	127 (51.2)	103 (41.5)	4.29	2 nd
The strategies have led to increase in rice yield	3 (1.2)	41 (16.5)	37 (14.9)	97 (39.1)	70 (28.2)	3.77	3 rd
Decreased occurrence of weeds	7 (2.8)	5 (2.0)	88 (35.5)	88 (35.5)	60 (24.2)	3.76	4 th
Ability to improve socio-economic condition (increase of income)	4 (1.6)	59 (23.8)	58 (23.4)	74 (29.8)	53 (21.4)	3.46	5 th
Reduction in pest infestation	11 (4.4)	55 (22.2)	50 (20.2)	74 (29.8)	58 (23.4)	3.46	5 th
Increase of soil fertility	35 (14.1)	52 (21.0)	47 (19.0)	49 (19.8)	65 (26.2)	3.23	7 th
Ability to plant throughout the year	43 (17.3)	43 (17.3)	60 (24.2)	51 (20.6)	51 (20.6)	3.10	8 th
Easy germination of rice seeds	53 (21.4)	49 (19.8)	55 (22.2)	60 (24.2)	31 (12.5)	2.87	9 th
Availability of water for irrigation	78 (31.5)	54 (21.8)	52 (21.0)	35 (14.1)	29 (11.7)	2.53	10 th

Source: Field Survey, 2023 S.D = Strongly Disagree; D = Disagree; U = Undecided; A = Agree; S.A = Strongly Agree; M.S = Mean Score

The Determinant Factors of Climate Adaptation Strategies

The results in Table 3 showed the result of multiple regression analysis showing the determinants of climate adaptation strategies used in rice production. The result revealed that both level of education ($t = 1.729$, $p < 0.05$) and household size ($t = 0.197$, $p < 0.05$) had positive significant relationship with the climate adaptation strategies used by the rice farmers. Farm size ($t = - 0.372$, $p < 0.05$), however, have negative significant relationship with the use of climate adaptation strategies. This result implies that the higher the house size and educational status of the rice farmers, the higher the usage of climate adaptation strategies. The higher the farm size, the lower usage of climate adaptation strategies. This implies that the level of education and household size could significantly influence rice farmers' ability to utilize climate adaptation strategies in the study area. This result is in agreement with the findings of Balasha et al. (2023), Banjoko et al. (2021) and Oluwole and Shuaib (2016) which reported that household size and educational level have influence on the use of Climate adaptation strategies

Table 3. Summary of multiple regression analysis showing the determinants of climate adaptation strategies used in rice production (n = 248)

Predictors	Coefficient Beta	Std. Error	t-value	Sig.
(Constant)	2.415	0.118	20.538	0.000
Sex	0.036	0.031	1.155	0.249
Age	0.002	0.002	0.786	0.433
Marital Status	-0.043	0.038	-1.134	0.258
Level of Education	0.131	0.018	1.729*	0.041
Household Size	0.098	0.006	0.197*	0.034
Rice Farming Experience	-0.003	0.003	-0.954	0.341
Rice Farm Size	-0.104	0.010	0.372*	0.038
Annual Income	-1.690E-008	0.000	-0.283	0.778

Field Survey, 2023 *significant at 0.05 level (2-tailed), R square=0.473, adjusted R square=0.112, F-value=0.702

CONCLUSION and RECOMMENDATIONS

Based on the findings of this study, the study concluded that adjusting planting and harvesting dates was the highest ranked climate adaptation strategy. The increase in quality of rice produced was the highest ranked perceived benefit of usage of climate adaptation strategies. The educational level, household size and farm size were the determinant factors of the usage of climate adaptation strategies in the study area.

According on the findings and conclusion of this study, the following recommendations are made;

1. Rice farmers should adopt the main adaptation strategies such as adjusting the planting and harvesting dates, application of traditional irrigation agriculture and livelihoods diversification in order to improve their rice outputs, income and food security.
2. Extension agents should provide up to-date information to the rice farmers on the weather forecast and climate adaptation strategies.

Conflict of Interest

The authors have declared no conflicts of interest.

Authors Contribution

The authors contributed equally to the article.

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