EFFECTS OF FLOOD ON RICE FARMERS' FOOD SECURITY IN AGRICULTURAL ZONE I OF NIGER STATE

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ABSTRACT

This study determined the effects of flood on rice farmers' food security in Agricultural Zone I of Niger State. A multistage sampling technique was used to select 127 rice farmers affected by flood and 127 rice farmers not affected by flood. Primary data were used for this study. The data were collected with the assistance of a well-trained enumerator using questionnaire. Descriptive statistics and logit regression) were used to achieve the objectives. The result showed that 96.1% of rice farmers not affected by flood were food secured while 73.2% affected farmers were food secured. The coefficient of household size, extension access, cooperative, farm income, value of crop loss due to flood and days farm had effect on food security. Raising seed bed ($\bar{X}$ =4.59), planting flood resistance seeds ($\bar{X}$ =4.50) were the most coping strategies adopted by rice farmers affected by flood to mitigate effects of flood while emergency water storage ($\bar{X}$ =4.40), agricultural insurance of farm ($\bar{X}$ =4.40) were the most coping strategies adopted by rice farmers not affected by flood to mitigate flood. It is recommended that rice farmers affected by flood to insure their farm in order to avert unforeseen circumstances**.** Rice farmers should put every measure in place to control floods in the study area. It is recommended that post-flood soil rehabilitation be adopted to mitigate the negative effect of flood.

KEYWORDS: Flood, Rice farmers, Food security

INTRODUCTION

Rice plays a vital role in ensuring sustainable food security as well as provision of employment and income to the nation's teeming population. Nigeria has been a major consumer and importer of rice in Africa. Indeed, rice is classified among the top four agriculture imports in Nigeria along with wheat, sugar and fish (Okafor *et al.,* 2020). It has been reported that the country spends over ₦356 billion on yearly importation of rice, out of which about ₦1 billion is used per day (Adenega *et al.,* 2021). Rice production in Nigeria is mainly rain-fed and most of the farming activities are carried out along the water plain which increases their vulnerability to flood (Apuyor *et al.,* 2023). Flooding is one of the most widespread natural disasters globally, exacerbated by climate change, which has increased the frequency and intensity of extreme weather events (IPCC, 2014; Agbadaga *et al.,* 2021). These events disrupt agricultural activities, causing significant losses in crop yields and threatening food security. In Africa, the impacts of flooding on agriculture and food security are particularly severe due to the continent's high dependence on rain-fed agriculture and limited adaptive capacity. According to the United Nations Environment Programme (UNEP),

Africa's agricultural sector is highly exposed to climate variability, and flooding is one of the major climate-related risks (UNEP, 2018). In sub-Saharan Africa, floods have caused significant disruptions to farming activities. For example, the 2019 floods in East Africa affected over 3 million people and led to widespread crop failures (Agbadaga *et al*., 2021). Flooding not only destroys crops but also damages infrastructure such as irrigation systems and storage facilities, further reducing agricultural productivity and food availability. Flooding can wipe out entire harvests, leading to significant income losses for farmers and increased food insecurity. In other world the supply chain, leading to higher food prices and reduced access to food for consumers. (Agbadaga *et al*., 2021). Several factors contribute to the frequent flooding in Nigeria. These include heavy rainfall, poor drainage systems, deforestation and the opening of the Lagdo Dam in Cameroon. The Niger and Benue rivers, which traverse the country, often overflow their banks during the rainy season, leading to widespread flooding in adjacent farmlands (NEMA, 2018). Niger State is one of the states with re-occurring flood incidences. In 2020, there was a devastating flood in about 20 Local Government Areas (LGAs) of the State which mostly affected crops, livestock, buildings, human lives, and farmlands that led to a significant decrease in the actual capacity of crop and livestock production (ENVIRON, 2020). The socioeconomic implications of flooding extend beyond immediate crop losses. Flooding disrupts the livelihoods of farming households, leading to increased poverty and food insecurity. According to the World Food Programme (WFP), floods in Nigeria often result in displacement, forcing farmers to abandon their homes and farmlands (WFP, 2018). Food security as a situation where all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO, 2020). These events have exacerbated food insecurity in a region already struggling with high levels of hunger and malnutrition. The objectives of the study are to: describe the food security of rice farmers in the study area; determine the effect of flood on food security and examines the coping strategies used in flood mitigation.

RESEARCH METHODOLOGY

The study was conducted in Agricultural Zone I of Niger State, Nigeria. The Zone comprises Agaie, Bida, Edati, Gbako, Katcha, Lapai, Lavun and Mokwa Local Government Areas (LGAs) of Niger State, Nigeria. Niger State is located between Latitude 9^{o} 93’N and 11^{o}30’N and Longitude 5^{o}65’N and 7^{o}20’E and covers a land area of about 76,363 km^2 of about 8% of Nigeria’s total land area. This makes it the largest in the country in terms of land mass. (NBS 2024). The mean annual temperature of the study area is between 35^{0}C - 360^{0}C with maximum temperature between March and June while the minimum 20^{0}C-210^{0}C is between December and January (NBS 2023). Annual rainfall ranges from 1,100mm in the northern part to 1,600mm in the southern part of the State. The rainy season lasts for about 150 days in the Northern parts while it is about 120 days in the Southern parts of the State. (NBS, 2023). The total population of the State ware over 28, 2300,932 people (NPC, 2023). Generally, the availability of natural water along the river Niger valleys and the type of soil permits the cultivation of most of Nigeria’s staple crops including rice, maize, sorghum, millet, soybean, cowpea, yam and groundnut. While some of the tree crops cultivated are mango and cashew. Livestock reared include goat, sheep, cattle and fowl. The State has 25 Local Government Areas (LGAs) with three Agricultural Zones (Niger State Geographic Information System 2023). The major agricultural produce in the State includes; rice, maize, yam, cassava, beans, and sorghum.

Sampling Technique and Sample Size

A multistage sampling technique was used to select respondents for this study. The first stage involved the purposive selection of four LGA' s in Agricultural Zone I of Niger State namely Agaie, Katcha, Lapai, and Mokwa LGA in the second stage, three (3) communities were selected from each of the LGAs using random sampling technique to give a total of twelve communities. In the third stage, a total of 254 rice farmers were selected from a total sampling frame of 938 comprising of 127 rice farmers who were affected by flood and another 127 farmers who were not affected by flood. Yamane (1967) formula adopted by Ibrahim *et al.* (2023) was used to obtain an appropriate sample from the sampling frame. Yamane is expressed in the equation (3.1)

$$n = \frac{N}{1+N(e^2)} \qquad (3.1)$$

Where:
n = targeted number of respondent;
N = sampling frame, and

1 = constant (0.05).

Table 1: Sampling frame and sample size of rice farmers in the study area

	Rice farmers affected by flood			Rice farmers not affected by flood		
LGA	Communities	Sampling Frame	Sample Size	Communities	Sampling Frame	Sample size
Agaie	Baro	27	7	Loguma	44	12
	Essun	45	12	Zago	42	11
	Ankwanu	47	13	Soje	38	10
Katcha	Gbakogi	46	13	Shabawoshi	45	12
	Echegi	21	6	Gbapo	49	13
	Kippo	26	7	Kashe	54	15
Lapai	Old-muye	31	8	Ebbo	34	9
	Achiba	50	14	Yeluwa	18	6
	Arah	41	11	Katakpa	28	8
Mokwa	Kpata 1	48	13	Tayi	45	12
	Gbara	56	15	Fofo	30	8
	Muregi	31	8	Gakpan	42	11
Total 4	12	469	127	12	469	127

Source: Field survey (2024)

Methods of Data Collection

Primary data was used for the study. Data were collected using a structured questionnaire and Kobo collect mobile application to collect relevant information on rice farmers affected by flood and rice farmers not affected by flood in the study area. The researcher was assisted by well-trained enumerators in data collection.

Analytical techniques

Food security index

Objective (i) was achieved using food security index of the rice farmer's. The rice farmers were classified into food secure and food insecure rice farmers using food security index, (Adebayo *et al.,* 2021) which is given as:

$$Fi = \frac{Per\ capita\ food\ expenditure\ for\ the\ irice\ farmers}{\frac{2}{3} of\ the\ mean\ per\ capita\ food\ expenditure\ for\ all\ rice\ farmers} \quad (3.2)$$

Where; Fi = Food Security Index.

Where; Fi ≥ 1 = Food secure i^{th} rice farmer and

Fi ≤ 1 = Food insecure i^{th} rice farmer.

A food secure rice farmer is therefore, that farmers whose per capita monthly food expenditure is above or is equal to two- thirds of the mean per capita food expenditure for all rice farmers. A food insecure farmer is that whose per capita food expenditure is below two thirds of the mean monthly per capita food expenditure. This method has been applied to a study, whose main focus was to analyze the food security status of urban households in Lagos (Bayen *et al.,* 2021).

Logistic regression model

Objective (ii) was analyzed using the logistic regression model to determine the effects of flood on the rice farmer's food security status. The implicitly formula for the logistic regression model is specified as

$L_¡ = (Z_¡/1Z_¡)\ X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, e_{¡}$ (3.3)

Where:

$L_¡$ = Logit;

$Z_¡$= food insecure;

1-$Z_¡$= food secure;

The explicitly form for the logistic regression model is specified as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \beta_{14} X_{14} + e_i \quad (3.4)$$

Where:

X_1 to X_{14} (independent variables) specified as:

$Z_¡$ = Food security (1 = food secure, 0 = food insecure)

X_1 =Age of respondents (Years), X_2= Education level (Number of years spent in schooling), X_3= Household size (Number), X_4= Extension contact (number); X_5 = Membership of Cooperative (number), X_6= Farm size (Hectares), X_7= Annual off–farm income (₦); X_8= Annual farm income (₦); X_9= Total experience (years) X_{10}= Value of crop lost due to flood (₦)

X_{11}= Value of properties destroyed (₦), X_{12}= Loss of family member (number), X_{13}= Days farm (number), X_{14}= Strategies adopted by rice farmers (number), Ui =Error term X_1 to X_{14} = coefficient to be estimated.

Coping strategies adopted was achieved five-point Likert rating scale was allotted as follows: Highly adopted = (5), adopted = (4), not sure = (3), not very adopted = (2), not adopted (1). The decision point is ≥ 3 adopted, <3 not adopted.

RESULTS AND DISCUSSION

Food security of rice farmers

Table 2 indicated that 73.2% of the rice farmers affected by flood are food secure while 96.1% of rice farmers not affected by flood are food secure. This result conforms with the findings of Adebayo *et al.,* (2021) who found out that an increased in flood will result to food insecurity.

This implies that rice farmers not affected by flood were more food secured than the affected farmers. This could be attributed to negative effect of flood of rice farmer productivity in the study area.

Table 2: Food security of rice farmers

	Affected (n=127)		Not affected (n=127)	
	Frequency	Percentage	Frequency	Percentage
Food secure	93	73.2	122	96.1
Food insecure	34	26.6	5	3.9

Sources: Field survey, 2024

Effects of flood on the rice farmer's food security status

Table 3 revealed the result of logit regression used to determine the effect of flood on rice farmers' food security status. The results showed Pseudo R^2 of 0.517, indicating that about 51.7% of variations in rice farmers' food security were explained by the independent variables included in the model. The chi-square statistics was significant at 1% level of probability indicating fitness of the model. From the Z values, six out of the fourteen variables included in the model were statistically significant at 1% and 5% level of probability. Table 3 indicated that household size (-0.3001139) was negatively significant at 5% level of probability. This suggests that each additional unit in household is associated with a 0.30% decrease in the probability of households to be food insecure. This finding is in consonance with Jonathan *et al.* (2020) who stated that increase in households will result to food insecurity. Extension access (3.052149) was positively at 5% level of probability. This denotes that access to extension services is associated with 3.5% increase in the probability of households to be food secure. Cooperative (-5.569034) was negatively significant at 1% level of probability. This suggests increase in membership of cooperative is associated with a 5.5% decrease in the probability of households to be food secure. Farm income (-1.15e-06) was negatively significant at 5% level of probability. This implies increase in farm income will is associated with 1.1 of the households to be food secure. Value of crops loss due to flood (-3.32e-06) was negatively significant at 5% level of probability. This suggests that each additional unit in value of crops loss due to flood with a 3.3% decrease in the probability of households to be food secure. Days farm (-0.2826664) was negatively significant at 1% level of probability. This suggests that each additional unit in days' farm submerge with a 0.28% decrease in the probability of households to be food secure.

Coping Strategies to be adopted by Rice Farmers to Mitigate the Effects of Flood

Table 4 showed that the following strategies were adopted by rice farmers affected by flood, raised seed bed ($\bar{X}$ =4.59), planting flood resistance seeds ($\bar{X}$ =4.50), emergency water storage ($\bar{X}$ =4.40), crop diversification ($\bar{X}$ =4.39), early harvesting ($\bar{X}$ =4.28), change plant time ($\bar{X}$ =4.17), changing use of chemical ($\bar{X}$ =3.94), soil conversation measures (3.76) and afforestation ($\bar{X}$ =3.54). On the other hands, the rice farmers not affected by flood adopted the following farming strategies to mitigate flood namely; emergency water storage ($\bar{X}$ =4.40), agricultural insurance of farm ($\bar{X}$ =4.40), change planting date ($\bar{X}$ =4.17), early harvesting (3.94), changing use of chemical ($\bar{X}$ =3.94), raising bed farming ($\bar{X}$ =3.76), soil conservation ($\bar{X}$ =3.76), and afforestation ($\bar{X}$ =3.54). This finding shows that the rice farmers affected by flood adopted more of the farming strategies than those not affected. This might be attributed to the unprecedented effect of flood on the productivity and food security of rice farming households in the study area.

Table 3: Effects of flood on the rice farmer's food security status (n=127)

Variables	Coefficient	Std Err	Z – value
Age	0.0093	0.0252	0.37
Education	-0.1457	0.0984	-1.48
Household size	-0.3001	0.1342	-2.24**
Extension agent	3.0521	1.5109	2.02**
Cooperative	-5.5690	1.6559	-3.36***
Farm size	0.2204	0.3254	0.68
Off farm income	-0.0001	0.0001	-0.89
Farm income	-1.15e-0	5.36e-0	-2.15**
Total experience	-0.0000	0.0000	-1.46
Value of crops loss due to flood	-3.32e-0	1.22e-0	-2.72**
Value of properties destroyed	0.0001	0.0001	0.76
Loss of family member	-0.1830	0.6264	-0.29
Days farm submerge	-0.2826	0.0835	-3.38***
Strategies	0.1240	0.0855	1.45
Constant	-0.1308	8.7329	-0.01
Chi2	76.25***		
Pseudo R2	0.5167		
Log Likelihood	-35.6594		

Sources: Field survey, 2024
*** Significant at 1% level of probability, **=Significant at 5% level of probability

Table 4: Coping strategies to be adopted by rice farmers to mitigate the effects of flood

	Affected (n=127)		Not affected (n=127)	
Variables	Means	Decision	Mean	Decision
Planting of flood resistant seeds	4.50	Adopted	2.73	Not adopted
Crops diversification	4.39	Adopted	2.32	Not adopted
Raised bed farming	4.59	Adopted	3.79	Adopted
Soil conservation measures	3.76	Adopted	3.76	Adopted
Terracing	4.09	Adopted	4.09	Adopted
Afforestation	3.54	Adopted	3.54	Adopted
Change plant time	4.17	Adopted	4.17	Adopted
Post-flood soil rehabilitation	2.72	Not adopted	2.72	Not adopted
Early harvesting	4.28	Adopted	3.94	Adopted
Emergency water storage	4.40	Adopted	4.40	Adopted
Selective exploitation	2.38	Not Adopted	2.72	Not adopted
Changing use of chemical	3.94	Adopted	3.94	Adopted
Agricultural insurance of farm	1.26	Not adopted	4.40	Adopted

Sources: Field survey, 2024

CONCLUSION AND RECOMMENDATIONS

It can be concluded that rice farmers affected by flood were less food secured than those not affected. The coefficient of household size, extension access, cooperative, value of crop loss due to flood, days of farm submerge had effect on rice farmer's food security status. The most used coping strategies by rice farmers to mitigate the effect of flood were raised farm bed, and planting of flood resistance varieties. While the rice farmers not affected by flood adopted agricultural insurance of farm and emergency water storage. It is recommended that rice farmers affected by flood to insure their farm in order to avert unforeseen circumstances**.** Rice farmers should put every measure in place to control flood in the study area. Post-flood soil rehabilitation is not adopted by farmers in the study area. It is recommended that rice farmers affected by flood to insure their farm in order to avert unforeseen circumstances**.** Rice farmers should put every measure in place to control flood in the study area. It is recommended that post-flood soil rehabilitation be adopted by to mitigate the negative effect of flood.

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