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ASSESSING EFFECTS OF BOKO HARAM INSURGENCY ON FARM YIELD OF RICE FARMERS IN JERE LOCAL GOVERNMENT, BORNO STATE

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ABSTRACT

This study assessing the effects of Boko haram insurgency on the farm yield of rice farmers in Jere Local Government Areas of Borno State. The objectives of this study were to analyze the socioeconomic characteristics of rice farmers and assess the effects of Boko haram insurgency on farm yield in the study area. The data was obtained from 370 rice farmers across the Local Government Areas, through structured questionnaires. Multistage sampling procedures were used to accomplish the required number of sample size. The data were analyzed using descriptive statistics (frequency, percentage and mean) to describes socio economic characteristics of rice farming household heads and Analysis of Variance (ANOVA) to analyzed the effects of Boko haram insurgency on rice farming yields. The findings indicate that 77% of the respondents were male and the mean age was 29.5 years. This implies that the majority of the rice farmers were Male middle aged and within the economically active age groups. 80% of respondents engaged in rice farming as their primary occupation. Findings from the ANOVA result shows the insurgency caused a significant drop in farm yields, and even after the peak period of insurgency, yields didn't fully recover to pre-insurgency levels. The study concluded that Boko haram insurgency has significantly disrupted the Rice farm yield in the study area. The study recommended that Borno state government should establish Agro ranger a combined security outfits to provide security to farm land and protect farmers from being attacking by the sect. Federal government should introduce crop insurance programme to compensate farmers for losses of farm yield and income due to insurgent attacks.

Keywords: Boko-Haram Insurgency, Rice farm Yield, Analysis of Variance.

Introduction

Rice farming is a driving force of the economy in Jere Local Government, contributing significantly to the improvement of livelihoods, particularly for rice farmers, by generating income through the sale of rice output and contributing to economic prosperity for rice farming households, protecting them from falling into poverty. Borno State Ministry of Agriculture (BSMA)

(2023) revealed that rice farming is one of the main staple crops in the area, accounting for 14% of crops cultivated by farming households. Rice output was recorded at 130.2 metric tons in 2002, increased to 150.2 metric tons in 2010, and further rose to 186.6 metric tons in 2018.

However, according to BSBS (2023), there has been a secular decline in crop farming output in Jere Local Government in recent years, with rice farming output decreasing from 178.1 metric tons in 2019 to an average of 120.2 metric tons between the 2020 and 2021 farming seasons, and further dropping to 89.3 metric tons in 2022. This is a significant decline from its earlier contributions over the past decade. The report further revealed that this reduction in rice farming activities in recent years in the area has been exacerbated by the resurgence of insurgency, particularly by Jama'atu Ahlis Sunna Lidda' Awati Wal Jihad (Boko Haram) in the Northeast region, where Borno State serves as the epicenter of the group. Among all forms of insurgency in the state's recent history, the Boko Haram insurgency has had the most severe impact on the livelihood activities of the people.

The escalation of Boko Haram insurgency, which began in 2009, has virtually affected all sectors of the economy, particularly the crop farming subsector, where rice farming activities are under threat due to persistent bombings of farmlands, burning of farm products, kidnappings of farmers, and the occupation of communities where rice farming is predominant. These insurgent activities have significantly affected the economic sources of livelihood for farmers, as the majority have experienced reduced farming activities during the insurgency period. Farmers in the state have found it difficult to cope with the existing insurgency situation, with tens of thousands being displaced and seeking safety in host communities (Nur,2025).

Furthermore, Food and Agriculture Organization (FAO, 2023), consistent attacks by insurgents have discouraged farmers, reducing the frequency of their visits to farmlands for cultivation and limiting their participation in farming activities. Farmers are prevented from accessing farmland more than 5 km away from the main town, and in certain areas, only 3 km from town for farming activities, as imposed by state authorities. Additionally, restrictions on the purchase of farm inputs, especially chemical fertilizers and fuel due to their potential use by insurgents for insurgent activities—have further hindered farming operations. Limited access to marketplaces to sell farm produce has also contributed to the challenges. As a result, there has been a decline in farm yield and income, as well as deteriorating livelihood conditions among affected farming households. Many farmers have been rendered practically inactive in society, relying on humanitarian aid for survival. This has posed serious limitations to rice farming and livelihoods, particularly in rice farming communities, and has become a major source of concern for rice farmers in the Jere Local Government.

Several studies have been conducted on the effects of Boko Haram insurgency on crop farming, particularly rice farming, in Nigeria and globally, but they are not without shortcomings. Jare and Bunu (2021) and Gloria (2021) assessed the effects of Boko Haram insurgency on crop output in Adamawa State, Nigeria. However, Jare and Bunu's study had limitations, as it relied solely on descriptive statistics to describe the

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reduction in farm output before and during insurgency without linking it to inferential statistics such as Analysis of Variance (ANOVA), which has predictive power to describe relationships between variables and variations in data. This research work intends to fill this gap by applying inferential statistics in addition to descriptive statistics to analyze the effects of insurgency on rice farm output in the study area. Gloria (2021) focused only on the effects of insurgency on women rice farmers, failing to highlight its impact on male rice farmers. Additionally, the study did not provide empirical evidence on how rice farm output, in particular, was affected by the insurgency, despite the fact that farm output was among the worst-hit aspects and was expected to have multiple effects on the livelihoods of affected farmers. Therefore, this research work will fill the gap by analyzing the effects of insurgency on rice farm output, considering both male and female farmers in Jere Local Government. Mai, Fatima and Ahmad (2020) highlights effect of insurgency on farm income and potential of farm income in enhancing the means of livelihood of farming households, the study had limitation considered only farm income without farm output.

From the literature, several studies have examined the effects of Boko Haram insurgency on rice farming enterprises, with most of these studies conducted at the macroeconomic level. Even studies conducted at the microeconomic level, such as those by Jare and Bunu (2021) and Gloria (2021), failed to highlight the effects of Boko Haram insurgency on the livelihoods of rice farmers, particularly in terms of rice farm output in Jere Local Government.

Therefore, leaving a knowledge gap, this research was focused on rice farming enterprises at a microeconomic level to fill this gap by examining the effects of Boko Haram insurgency on the farm Yield of Rice farmer in the study area.

Research Method:

Research Design

The study uses primary data, sourced from farming household heads through structured questionnaire. Also, key informant interview was conducted with relevant stakeholders in rice farming enterprise. Other key concepts discussed such as the Population of the study area, Sampling Technique, Analytical techniques and method of data analyse.

Population

The population were total number of rice farmers engaged in rice farming in Jere LG. Although, the total number of rice farmers in the study area is not known because there was no reliable statistics showing that from relevant authorities. However, there are 10,000 rice farmers registered with Jere rice farmers association in the study area. The target population for this study were all farmers who have registered with this rice farmers association and who have been victim of Boko haram insurgency in the study area.

Sampling Technique and Sample Size

Sample size table formula developed by Morgan (1970) and adopted by Abdikadir (2013) were applied to select 370 rice farmers in this study, as attached in appendix i. Multi-stage sampling technique were employed to select the rice farmers for this research work, because the technique can compress population by fragmenting it into different micro groups and then subjected to a random sampling (Tamim,2019). In the first stage, out

of the 27 Local governments in Borno State, Jere local government is purposively selected not because rice farmers are severely affected by the insurgents, but the Jere is most accessible for questionnaire administration to rice farmers (RIFAN, 2023). In the second stage, a purposive sampling were used to select five (5) wards (Khaddamari/Zabarmari, Dusuman, Alau, Gongulon and Lawanti) out of the twelve (12) existing wards within Jere Local Government. At the third stage, simple random sampling procedure were used to select two (2) villages randomly in each of these five wards, making a total of ten (10) villages. In the fourth stage, snowball sampling technique developed by Goodman (1961) and adopted by Babagana et al., (2018) were employed in selecting thirty-seven (37) rice farming household heads from each of these ten (10) villages making a total of three hundred and seventy (370) respondents to meet the sample requiremen

The population and sample size will draw proportionally among five (5) wards selected for the study is shown in the table below:

Sample Frame

Rice farmers' population and sample size

Wards	Population	Sample
Zabarmari/Khaddamari	3850	142
Dusuman	2178	81
Alau	1628	60
Gongulon	1292	48
Lawanti	1052	39
TOTAL	**10,000**	**370**

Source: Rice farmers Association records, 2025.

A total of 370 copies of the well-structured questionnaire were administered to rice farming household heads in the thirty (30) villages selected in these five (5) local Government areas of Borno State. The number of questionnaires considered for analyse after data cleaning was only 366 rice farmers as others were discarded for inconsistency or incompleteness.

Construct Reliability and Validity Test

Reliability is a measure of internal consistency of the data. Reliability were tested using convergent validity through Cronbach's Alpha and composite reliability which must have 0.70 as threshold (Hair, *et al.* 2014). Cronbach's Alpha quantifies shows how well a set of items measures a single one-dimensional latent construct. A higher cronbach's alpha indicates higher internal consistency, meaning that items on the test are more homogeneously related to each other. Validity measures the fit between the data which shows extent the instrument measures what it is supposed to measure. The validity were tested on two dimensions convergent validity and discriminant validity. The convergent validity were determined using Average Variance Extracted (AVE) which is a threshold of 0.5.

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Method of Analysis:

Descriptive Statistic

Descriptive statistic such as percentages and frequency applied to examined socio economic characteristics of rice farmer households because descriptive statistic could be summarized and then combined variables contained in the data without listing every observation (Gujarati, 2018).

Analysis of Variance

This research work will apply analysis of variance (ANOVA), developed by Ronal Fisher in 1940, who examined the effectiveness of crops farming through compared one crop with others in Agricultural experiment. This Anova technique were applied in this research work, to examine the effects of Boko haram insurgency on rice output before and during insurgent activities in the study area by comparing mean output of 2018, 2019 and 2020 before insurgency started having noticeable effects on rice farming and that of 2021, 2022 and 2023 mean output of farming season during the peak period of insurgency in the study area (RIFAN, 2023). This is because Anova is a statistical test used to analysis differences among mean of more than two groups by comparing mean of multiple groups to determine whether there is a significant difference from each other. The one-way Anova is used to test whether the mean of several populations are different from each other under a single factor. The Anova test is performed by comparing two types of variation, the variation between the sample mean and variation within each of the samples. This research work will apply Anova technique used by Mai (2020) and Tamin (2019) and then modify some variables to suit this specific objective i, to examining effects of Boko haram insurgency on rice output before and during insurgent activities in the study area by comparing mean yield withing the scope periods of this research work.

Formula represents one-way Anova test statistics:

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares (MS)	F
Within	$SSW = \sum_{j=1}^{k}\sum_{j=1}^{l}(X-\bar{X}_j)^2$	$df_w = k-1$	$MSW = \frac{SSW}{df_w}$	$F = \frac{MSB}{MSW}$
Between	$SSB = \sum_{j=1}^{k}(\bar{X}_j - \bar{X})^2$	$df_b = n-k$	$MSB = \frac{SSB}{df_b}$	
Total	$SST = \sum_{j=1}^{n}(\bar{X}_j - \bar{X})^2$	$df_t = n-1$		

Source: Adana, 1990.

$F = \frac{MSB}{MSW}$

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$$MSB = \frac{SSB}{df_b}$$

$$MSW = \frac{SSW}{df_w}$$

Where:
F = Anova Coefficient
MSB = Mean sum of squares between the groups
MSW = Mean sum of squares within the groups
SSW = Sum of squares within the groups
SSB = Sum of squares between the groups
D.O.F = Degree of freedom
P = Total number of populations
n = Total number of samples in a population
N = Total number of observations
s = Standard deviation of the samples

Presentation of Results:

Table 1.0 Socioeconomic Characteristics of Rice Farmers (n=366)

Variable	Category	Frequency	Percentage (%)
Gender	Male	281	77.0
	Female	85	23.0
Age Range (Years)	18-25 years	74	20.0
	26-35 years	92	25
	36-45 years	74	20.0
	46-55 years	70	19
	Over 56 years	56	16
Marital Status	Single	98	27
	Married	209	57
	Divorced	12	3
	Widow	47	13
Household Size	1-4	37	10.0
	5-9	185	51.0
	10 and above	144	39.0
Educational Level	Primary	74	20.0
	Secondary	37	10.0
	Tertiary	18	5.0
	Quranic school	66	18
	Non-formal school	148	40.0
	None	23	7
Number of Years in Rice Farming	4 and below	70	20.0

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Variable	Category	Frequency	Percentage (%)
	5-9	92	25
	10-14	92	25
	15 and above	112	30

Source: Field survey,2024.

The result in Table 1.0 shows the distribution by gender shows majority of the rice farmers were Male 77% while the remaining 23% were Female. This implied rice farming is a male-dominated activity in the study area. This might be male farmers have great responsibility in their families as the heads to engaged in farming to supply food and other household basic needs.

The age distribution of respondents shows that 20% fall between 18-25 years, 25% of the rice farmers fall between 26-35 years, and 16% fall between 56 and above. This implies that the majority of the rice farmers were middle aged and within the economically active age groups, particularly 26-35 years which accounts for the largest proportion at 25%. This was a significant, as younger, active farmers could be more oriented and frequently adopt modern farming techniques than their older which contribute to agricultural innovations such as improved seed varieties and agrochemical which ultimately rise rice output and thereby leading to improve livelihood of rice farming households.

The result in Table 1.0 reveals 57% of surveyed rice farmers were married, while 27% were unmarried. The predominance of married farmers highlights a potential advantage in accessing family labor for farming activities. Marriage often corresponds with larger household sizes, enabling families to contribute labor directly to farming operations thereby lowering production expenses which support poverty alleviation efforts within farming communities.

Educational levels are varied, with 40% of respondents having non-formal education, 18% having attended Quranic schools, secondary10%, primary 20% and smaller proportions having tertiary education (5%). While those without any educational background (none) representing 7% respondents. This implied that 75% of rice farmers have some form of education background, tentatively equipping them to adopt improved practices. However, despite the high non-formal and formal education among rice farmers (75%) several farmers still can't adopt new innovations because of external factors such as insurgency where the insurgents are hindering this adoption through destroying farm inputs like seeds and fertilizers as well as preventing access to new methods, which reduces farm yield and income.

Farming experience in rice farming is well-distributed, with the largest proportion of respondents (30%) having more than 15 years of experience, indicating a high level of expertise among farmers. Others have between 5-14 years (50%) and 4 years and below (20%) of farming experience, showing a mix of seasoned and relatively new farmers. This revealed that majority of the rice farmers had long farming experience which could help them improve significantly on rice farming activities by adopted correct method of practices thereby leading to improvement of

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livelihood of farmers. Farmers with extensive experience are typically more efficient, possess deeper understanding of climate patterns and farming dynamics. However, despite their experience, rice yields plummeted by 45% during the study period of survey as presented in Table 2.0. This decline is likely related to the rise of Boko haram insurgency, as threats of insurgency and farm attacks have deterred farmers from accessing their farm lands which led to decline in farming activities and severely disrupted the livelihoods of farming households.

Table 2.0: **ANOVA Result on the Effects of Boko Haram Insurgency on Rice Yields**

Source	SS	Df	MS	F-value	p-value
Between	**125,678**	**2**	**62,839**	**62.96**	**<0.0001**
Within	**362,451**	**363**	**998**		
Total	**488,129**	**364**			

Source: Field survey,2024.

Table 2.0 presents an ANOVA analyse of the effects of Boko haram insurgency on rice yield before, during and after the peak period of insurgency in the study area. Sum of squares (SS) between groups is 125,678, which measures variation between the three group means (before, during, after) the peak period of insurgency and compared to the overall mean or total sum of squares. This implies high sum of squares between groups (125,678), shows differences in rice farm yields across the three periods are statistically significant and Boko haram insurgency had a significant effect on rice farm yields; because the means are far apart. The result further shows sum of squares within groups which measures a variation within each group; how much individual farmer farm yields differ from their group mean is 362,451 which is high, this implies there is considerable variability in farm yields within each period. This could be due to differences in farm size, access to farm inputs such as fertilizer, improved seed, access to market places, location, other uncontrolled factors among others.

The result shows that the total sum of squares (488,129) which represents the total variation in the dataset, which is partitioned into 125,678 for between-group variation, implies there is a systematic variation between groups, due to the effect of insurgency and since sum of squares between groups is a large portion of sum of squares total 488,129/125,678 (26%) implies that insurgency explains 26% a meaningful part of rice yield variation. Also, 362,451 for within-group variation which shows there is a random and considerable variability in rice yields within each period due to natural variability.

However, during the peak of insurgency, this figure dropped sharply to 40 tons. This decline was attributed to widespread fear of Boko haram insurgency, which deterred farmers from cultivating their lands and accessing required farm inputs. Additionally, several farmers attempted to farm often faced devastating losses, as insurgents frequently destroyed crops by setting fields ablaze and even killing farmers. Despite these challenges, farming activities,

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particularly crop cultivation began to recover gradually as some farmers returned to their lands. This resurgence was largely due to improved security conditions, allowing for a partial restoration of farming productivity, which led to average rice yield increased to 46 tons, reflecting a slow but positive shift in production levels.

The result in table 2.0 further shows mean square (MS) is 62,839, which signifies an average variation between group means, with high MS between group implies that, on average, a difference between the three periods is large relative to random fluctuations. The result further shows mean square (MS) for the within groups is 998, which represents the average variation within groups. The mean square (MS) for the between-group variation is 62,839 significantly larger than the mean square for within-group variation (1,007), implies that the group differences are not just due to random chance but as a result of Boko haram insurgency had a negative effect on rice farming yield. The F-statistic is calculated as 62.96 (62,839/998) with a corresponding p-value of 0.00 (probability that these differences occurred by chance is virtually zero), which is less than 0.05 is statistically significant at the 1% level; because a large F-value (62.96) implies that the between-group rice yield variation is higher than within-group rice yield variation. This strongly implies that the differences in rice yield across the three periods are statistically significant and there is a significant difference in rice yields before, during, and after the peak period of insurgency.

The Anova result in table 2.0 further confirms that insurgency had a highly significant impact on farm yields, with rice farming dropping during the peak period of insurgency and only partially recovering after the peak period of insurgency. The large F-value (62.96) and small p-value (0.001), confirms that these differences are real and due to negative effects of Boko haram insurgency on rice yield and not due to random fluctuations. The Anova result further confirms, SS between is greater than SS within, implies effect of insurgency is strong compared to random variability. The result also consistent with finding of focus group discussion conducted, clearly state that rice farming yield was more before the peak period of insurgency, drastically reduced during the peak period of insurgency. However, with the restoration of relative peace in 2023/2024 as a result of which several displaced farmers returned to these towns, farming activities particularly, rice farming gradually picked up which led to a good bumper harvest after the peak period of insurgency.

Table 3.0 : Tukey's HSD Post Hoc Test for Effects of Boko Haram Insurgency on Rice Yield

Comparison	Mean Difference	95% Confidence Interval	P-value	Significance
Before vs. During	33	(23.5, 42.5)	0.001	Significant
Before vs. After	25	(15.5, 34.5)	0,004	Significant
During vs. After	8	(-1.5, 17.5)	0.008	Not Significant
Critical HSD Value:	9.47			

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Source: Field survey,2024.

Table 3.0 shows the results of Tukey's HSD post hoc test for the effects of Boko Haram insurgency on rice yield. The pairwise comparison between rice yield before and during the insurgency shows a mean difference of 33 which has exceeded critical HSD threshold value of 9,47 The 95% confidence interval for the difference in means ranges from 23.5 to 42.5. The p-value is 0.001, which is statistically significant, indicating that there is a significant difference in rice yield before and during the insurgency This implies rice yields dropped 33 units during insurgency due to disrupted to farming activities, displacement of farmers and farm labours as well as destroyed farm infrastructure. The result further shows comparison between rice yield before and after the insurgency shows a mean difference of 25 and exceeds HSD threshold value of 9,47. The 95% confidence interval for the difference in means ranges from 15.5 to 34.5. The p-value is 0.004, which is statistically significant, indicating that there is a significant difference in rice yield before and after the insurgency. This implies rice yields remained 25 units lower post-insurgency than pre-insurgency, indicating partial restoration post-insurgency but incomplete recovery due to lingering challenges such as limited farm inputs, inadequate access to market and limited farm labourers among others. The Tukey's HSD post hoc result also, shows comparison between rice yield during and after the insurgency shows a mean difference of 8 and not exceeds HSD threshold value of 9,47; the 8 unit increases in rice yield after insurgency is not statistically significant. Also, the 95% confidence interval for the difference in means ranges from -1.5 to 17.5. The p-value is 0.008 which is statistically not significant, indicating that there is no significant difference in rice yield during and after the insurgency. This further implies rice yields did not fully recover to pre-insurgency levels and meaning that recovery efforts by rice farmers had limited impact on rice yields in the study area.

The pairwise differences are 33 (before-during), 25 (before-after), and 8 (during-after). Comparing these to the HSD threshold value of 9.47, before-during and before-after are significant, but during-after is not. This means that the insurgency caused a significant drop in yields, and even after the peak, yields didn't fully recover to pre-insurgency levels. However, the increase from during to after wasn't statistically significant, indicating limited recovery. Tukey's HSD clarifies that Boko haram insurgency caused a catastrophic yield drop, with no full recovery post-conflict.

Discussion of Findings:

The Anova analyse examining the effects of Boko haram insurgency on rice yield across three periods (before, during, and after the peak insurgency) reveals key insights into the sources of variation in rice yield. This compares the between-group variation to within-group variation. A high F-value 62, with a p-value0.001 which is less than 0.05, confirms statistically significant differences in rice yields and Boko haram insurgency had a systematic effect on rice yield across the three periods and differences between group means are large relative to variability within groups. Yields had declined during the peak insurgency and partially recovered afterward. The result was collaborated by Glorial (2021) examined trends in rice production before, during, and

after the height of insurgency. Before the conflict, the average rice yield was 76 tons.The findings also aligned with Jare and Bunu (2021) where the study highlighted, based on Anova results where pearson chi-Square value of 27.496 and the likelihood ratio of 27.622 in relation to their degree of freedom value of 12 shows that the alternate hypothesis should be accepted and the null hypothesis rejected; because insecurity absolutely had economic implications on crop farming in the study area.

Furthermore, Tukey's HSD result clarifies that Boko haram insurgency caused a catastrophic yield drop, with no full recovery post-conflict; because pairwise differences are 33 (before-during insurgency), 25 (before-after insurgency), and 8 (during-after), comparing these to the HSD threshold value of 9.47, before-during and before-after are significant, but during-after is not. This means that the insurgency caused a significant drop in yields, and even after the peak, yields didn't fully recover to pre-insurgency levels. However, the increase from during to after wasn't statistically significant, indicating limited recovery. The study collaborated by Mai et al. (2020) empirically established through ANOVA analyse that Boko haram insurgency exerted persistent negative effects on Rice incomes in Borno State, even during post-conflict periods. Findings revealed that most farming operations failed to achieve full productive capacity due to significant portions of arable land remaining uncultivated as a direct consequence of insurgent activities. This sustained productivity deficit emphasizes the long-term economic consequences of insurgency on agrarian livelihoods.

Conclusion:

the study concluded on Anova result, that Boko haram insurgency caused a significant decreased in farm yields and even after the peak period of insurgency, yields didn't fully recover to pre-insurgency levels. However, the marginal increases in far yield after the peak period of insurgency was statistically not significant at 5 level, indicating limited recovery. In objective iv, the study concluded Boko haram insurgency has significantly impacted the employment status of rice farmers in the study by disrupted their primary livelihood occupation. Insurgent activities have not only reduced farm yields and incomes but have also limited employment opportunities in rice farming particularly, to rice farmers.

Recommendations

Based on the findings of this study, the following recommendations were proposed:

Security Enhancement.: The study recommended that Borno state government should establish Agro ranger a combined security outfits to provide security to farm land and protect farmers from being attacking while cultivating their land by the sect; deploying security personnel could to reduce insurgent threats and improve both farm yields and income in the study area.

Conduct community resilience programs: The affected local governments in collaboration with non-governmental organizations (NGOs) should conduct community resilience programs to rebuild trust and develop family members particularly, youth engagement initiatives to safe participation in farming through collective farming efforts. Equally, non-governmental organizations provide psychosocial support because, several farmers

were victims of trauma caused by insurgency. Providing psychosocial support and counselling services can help them cope with the psychological effects of insurgency.

Crop Insurance Schemes: Federal government should introduce crop insurance programme to compensate farmers for losses farm yield and income due to insurgent attacks.

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