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Original Research Article

Insecurity, Food Scarcity, and Agricultural Decline: Insights from Arable Crop Farmers in the North Central Zone of Nigeria

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Abstract: This study investigates the impact of insecurity on food scarcity among arable crop farmers in the North Central Zone of Nigeria. It provides a thorough analysis of the security challenges farmers face, the implications of these challenges on agricultural productivity, and the strategies they adopt to cope. The research identifies the most prevalent forms of insecurity in the region, including crop theft (88.9%), crop destruction (76.4%), banditry and armed attacks (69.4%), farmer-herder conflicts (68.1%), the Boko Haram insurgency (66.4%), and kidnapping (64.2%). These security threats have led to a significant decline in household income, with 43.3% of farmers earning between ₦20,000 and ₦50,000 monthly during periods of insecurity, compared to 35.8% before insecurity escalated. The study establishes a direct relationship between insecurity and food scarcity, with 33.3% of farmers reporting severe food shortages and 30.6% frequently reducing food variety due to these shortages. Furthermore, factors such as climate change, postharvest insecurity, household size, and other socioeconomic variables are found to significantly affect agricultural productivity. In response, farmers have adopted strategies like seeking financial assistance (76.4%), reporting incidents to authorities (73.6%), and engaging in local security groups (69.4%). Paired samples analysis confirms that insecurity has substantially reduced crop yields, underscoring its detrimental effect on agricultural output. The study calls for urgent policy interventions to address the complex challenges posed by insecurity, to safeguard food security in the region.

Keywords: Insecurity, Food Scarcity, Agricultural Livelihoods, Agricultural Disruption, Food Security.

INTRODUCTION

Agriculture is the cornerstone of many economies in sub-Saharan Africa, with Nigeria being no exception. In particular, the North Central Zone, often referred to as the "food basket" of Nigeria, plays a critical role in ensuring the country's food security. This region contributes substantially to national agricultural output, producing significant quantities of staple crops, including maize, cassava, yam, millet, sorghum, and rice (FAO, 2020; Okonkwo & Nwosu, 2024; Matemilola & Elegbede, 2017). The North Central Zone, which includes states such as Benue, Kogi, Nasarawa, Niger, Kwara, Plateau, and the Federal Capital Territory (FCT), is vital not only for local food consumption but also for the country's broader food security framework. However, this region's pivotal role is being increasingly jeopardized by rising insecurity, which has severely disrupted agricultural productivity and compromised food security at both the local and national levels.

Insecurity in the North Central Zone manifests in various forms, including crop theft, destruction of crops, armed banditry, farmer-herder conflicts, and other violent acts (Johnson *et al*., 2023; Abubakar *et al*., 2021). These security threats have led to widespread disruptions in farming activities, displacing farmers, destroying farmlands, and hindering the movement of agricultural goods and services. Consequently, the decline in agricultural productivity has directly impacted food availability, exacerbating food scarcity both in local communities and nationally.

The relationship between insecurity and agricultural decline has been extensively documented in the literature, particularly in conflict-prone regions where violence, farmer-herder disputes, and insurgency activities disrupt farming practices and food production (Oyinbo *et al*., 2022). Numerous studies have highlighted how insecurity worsens the challenges of agricultural production, leading to reduced output, increased production costs, and widespread displacement

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of farmers (Adegoke *et al.,* 2023). In Nigeria, the escalation of farmer-herder conflicts and the Boko Haram insurgency in the northeast has profoundly affected food production in the North Central Zone, exacerbating food insecurity (Oyinbo *et al*., 2022). These security challenges not only diminish food production but also result in rising food prices, displacement of farming communities, and increased poverty levels in the region.

The impact of insecurity on food security is multifaceted. For instance, research by Eze & Okorie (2024) and Adebayo *et al*., (2021) underscores the growing frequency of farmer-herder clashes, driven by competition over land and water resources, alongside rising banditry and communal conflicts. These factors force farming communities to flee their lands, leaving farmlands abandoned, which further disrupts food production. Similarly, Aliyu & Bello (2023) and Adesugba *et al*., (2020) document the struggles faced by farmers who are compelled to abandon their agricultural activities due to threats of violence, theft, or destruction. The continual disruption of planting, harvesting, and land maintenance activities due to insecurity diminishes crop yields, reduces household food supply, and increases the likelihood of food shortages (Fadairo *et al*., 2019).

Additionally, the displacement of farmers, coupled with the destruction of crops and farming equipment, has exacerbated food scarcity in the North Central Zone. Many displaced farmers cannot return to their original farmlands, as the continued insecurity renders these areas unsafe for farming. Eze & Okorie (2024) note that conflict-induced displacement is a primary driver of food insecurity, as it disrupts agricultural production and food supply chains. Displaced farmers also face difficulties accessing markets to sell their produce, while the lack of adequate storage facilities leads to post-harvest losses, which further intensifies food scarcity.

Beyond the direct effects on food production, the insecurity crisis has significant socio-economic consequences for rural communities. As food production declines, food prices have sharply increased, disproportionately affecting vulnerable communities dependent on subsistence farming. Rising food prices are not only a direct result of agricultural disruptions but also due to logistical challenges posed by insecurity, such as blocked transportation routes and heightened risks when traveling to markets (Abubakar *et al*., 2021). These rising prices exacerbate poverty levels and malnutrition, making it difficult for many rural households to afford basic foodstuffs, further reducing the standard of living for farming families (Adebayo *et al*., 2021). Fadairo *et al*., (2019) argue that the agricultural sector, which is largely dominated by smallholder farmers, remains particularly vulnerable to insecurity, given their limited access to essential resources, such as security, capital, and modern farming technologies.

The socio-economic impact of insecurity extends to the farmers' ability to access vital agricultural inputs. Oyinbo *et al*., (2022) report that insecurity has significantly hindered the movement of goods and services, limiting farmers' access to key agricultural inputs, such as seeds, fertilizers, and pesticides. This limitation has led to a reduction in agricultural productivity and disrupted income generation. The United Nations' Committee on World Food Security defines food security as a condition where "all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life" (FAO, 2024; FAO *et al*., 2020). However, the ongoing insecurity in the North Central Zone undermines this definition by obstructing agricultural production, limiting access to markets, and making it increasingly difficult for farmers to meet their food security needs (Matemilola & Elegbede, 2017).

In addition to the direct effects of insecurity, environmental and climate-related factors exacerbate food scarcity in the region. Shiru *et al*., (2020) report that the unpredictable weather patterns, flooding, and droughts caused by climate change further complicate farming in the North Central Zone. These environmental challenges, combined with inadequate agricultural extension services, poor infrastructure, and insufficient government support, make farmers highly vulnerable to both natural and man-made challenges that undermine food production (Fadairo *et al*., 2019). In such an insecure environment, farmers are less likely to adopt modern farming techniques, experiment with new crop varieties, or invest in irrigation and other agricultural improvements, which are necessary for boosting productivity and meeting the growing food demand (Adebayo *et al*., 2021).

Although there is substantial documentation of insecurity's effects on agriculture in Nigeria (Adeyemi *et al*., 2020; FAO, 2020), there remains a notable gap in the literature regarding the specific effects of insecurity on food scarcity among arable crop farmers in the North Central Zone. Given the region's importance in Nigeria's agriculture, coupled with its vulnerability to security challenges, a focused investigation into how insecurity affects food production and availability is essential.

This study seeks to bridge this gap by examining the effects of insecurity on food scarcity among arable crop farmers in the North Central Zone of Nigeria. Through an exploration of the impact of insecurity on farming activities, food supply chains, and food prices, this study aims to provide a comprehensive understanding of the root causes of food scarcity in the region. The findings will contribute to policy recommendations and offer practical solutions for addressing food scarcity, supporting displaced farmers, and ensuring food security in the face of escalating insecurity. Ultimately, the study's outcomes will guide

targeted interventions to bolster the agricultural sector and promote long-term food security in Nigeria.

MATERIALS AND METHODS

This study was conducted in two states, Benue and Niger, both situated within Nigeria's North Central geopolitical zone, a region critical to the country's agricultural output. Benue State, established in 1976, covers an area of 30,783 km² and is divided into 23 Local Government Areas (LGAs), with Makurdi serving as the capital. The state's geographical coordinates are 7°20'N latitude and 8°45'E longitude. As of 2023, its population was estimated at approximately 6.14 million. Known for its agricultural abundance, Benue is often referred to as the "food basket of the nation," owing to its extensive production of both cash and arable crops. Niger State, founded in 1967, is the largest state in Nigeria, spanning 1,266,700 km² and consisting of 25 LGAs, with Minna as its capital. Geographically, the state is located between 8°20'N to 11°30'N latitude and 3°30'E to 7°20'E longitude. The state's population, as of 2023, was estimated at 27.2 million. Niger experiences a tropical climate, with temperatures ranging between 23°C and 37°C and annual rainfall varying from 1,100 mm to 1,600 mm. The region is dominated by short grasses, shrubs, and scattered trees, with agriculture, both crop cultivation and livestock farming—serving as the primary economic activity for its inhabitants. Together, Benue and Niger States provide a significant context for understanding the challenges faced by farmers, especially in light of the region's increasing insecurity.

Sampling Techniques

This study employed a multistage sampling technique to ensure that the respondents adequately represented the diverse characteristics of farming households in Nigeria's North Central region, particularly those most affected by various forms of insecurity in recent years. The sampling procedure was carried out in four distinct stages. In Stage 1, two states were selected from the North Central zone, based on their prominence in arable crop farming and the frequency of reported insecurity incidents. In Stage 2, four Local Government Areas (LGAs) were chosen from each state to ensure broad representation of varying socio-economic and agricultural contexts. Stage 3 involved the selection of three communities within each of the selected LGAs. Finally, in Stage 4, 15 arable crop farming households were randomly selected from each community, resulting in a total sample size of 360 households (15 households x 3 communities x 4 LGAs x 2 states). Data were collected through structured questionnaires, which covered key variables such as farm insecurity, food scarcity, socio-economic characteristics, agricultural productivity, and coping strategies. Key informant interviews were conducted with agricultural extension workers and community leaders, while focus group discussions provided additional insights from groups of farmers regarding common challenges and responses to farm insecurity. The collected data were analyzed using both descriptive and inferential statistics. Descriptive statistics, including frequency counts, percentages, and means, were employed to examine the socio-economic characteristics of the farmers. These techniques also facilitated an assessment of the types and prevalence of insecurity affecting farmers, its impact on their production levels and income, as well as the food scarcity challenges they faced in their agricultural activities. For the inferential analysis, linear regression and paired t-tests were applied. The paired t-test was used to evaluate the statistical significance of differences in crop production before and during the period of insecurity, while linear regression analysis was used to explore the effect of insecurity on the quantity of food produced by arable crop farmers, both before and during the insecurity period.

Model Specification

Linear regression was used to evaluate the effect of specific types of insecurity on the quantity of food produced during and before insecurity:

Crop Production during Insecurity = $\beta 0+\beta 1$ (Theft) + $\beta 2$(CC) + $\beta 3$(MKTAC) + $\beta 4$(HHS) + $\beta 5$(VAN) + $\beta 6$ (BAN) + $\beta 7$ (VIOL) + $\beta 8$(CON) + $\beta 9$(ECIN) +$\beta 10$(FINS) + $\beta 11$(INCL) +ϵ

Crop Production before Insecurity = $\beta 0+\beta 1$ (Theft) + $\beta 2$(CC) + $\beta 3$ (MKTAC) + $\beta 4$ (HHS) +$\beta 5$(VAN)+$\beta 6$(BAN)+ $\beta 7$(VIOL)+ $\beta 8$(CON) + $\beta 9$(ECIN) +$\beta 10$(FINS) + $\beta 11$(INCL) +ϵ

Where

Theft= dummy (1 = yes, 0 = no).

Climate Change (CC) = dummy (1 = yes, 0 = no).

Market accessibility= dummy (1 = yes, 0 = no).

Household Size (HHS)= number of members in the household

Vandalism (VAN)= dummy (1 = yes, 0 = no).

Banditry (BAN)= dummy (1 = yes, 0 = no).

Violence (VIOL)=dummy (1 = yes, 0 = no).

Farmer-herder Conflict (CON)=dummy(1 = yes, 0 = no).

Economic Insecurity (ECIN):

This can be defined as a continuous variable reflecting the perceived economic stability of the household, measured through factors such as market price volatility or changes in income levels (1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree

Financial Insecurity (FINS)=scale (1 = Very low access to financial resources; Low access; 3 = Moderate access; 4 = Good access; 5 = Very good access

Income Level (INCL)= (₦)

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Arable Crop Farmers

Age of Respondents

The age distribution of farmers in the North Central Zone reveals that 38.3% of respondents fall within the 35–44 years age group, followed by 32.8% in

the 45–54 years category. A smaller proportion, 6.7%, are aged 65 years and above, while only 2.8% fall below 25 years. This demographic composition suggests that arable crop farming in the region is predominantly undertaken by individuals within their economically productive years. Such individuals are typically more energetic, resourceful, and inclined to adopt innovative farming practices or technologies, provided that security conditions remain conducive. The presence of a workforce predominantly composed of these age groups indicates a potentially dynamic agricultural sector, capable of enhancing productivity, assuming that external threats, particularly insecurity, are mitigated.

However, the conspicuously low youth participation in agriculture raises concerns, particularly in the context of ensuring the sustainability of farming in the region. This observation aligns with Abayomi *et al*., (2024), who identified a growing disengagement of younger people from agriculture, attributed to perceived low returns, security risks in rural areas, and unfavorable environmental conditions. The persistent threats of banditry and communal conflicts have further discouraged youth involvement in agriculture, particularly in regions prone to conflict. In contrast, while older farmers continue to play an important role in the agricultural sector, their ability to contribute effectively is constrained by the security challenges they face. Although the age structure of farmers predominantly comprises economically active individuals, the persistence of insecurity undermines the capacity of both younger and older farmers, ultimately reducing agricultural productivity and exacerbating food scarcity.

Household Size

The study indicates that 33.3% of households have between 4 and 6 members, 30.6% have between 7 and 9 members, 22.2% have 10 or more members, and 13.9% have between 1 and 3 members. These relatively large household sizes suggest a potential for family labour to support farming activities (Akpan *et al*., 2023). This labour force could be instrumental in mitigating the effects of insecurity, particularly when access to external labour becomes either costly or unsafe. Households with moderate sizes are generally better able to adapt during crises by reallocating internal labour to activities such as security patrols, food processing, or storage.

However, larger households, which tend to have more dependents, may experience greater pressure on available food and income resources. In the context of insecurity, larger households are more likely to suffer from food scarcity due to disruptions in production and supply chains. Conversely, smaller households may lack the labour force required to sustain agricultural productivity during periods of conflict. These households may be forced to reduce farm sizes or abandon agricultural activities entirely when faced with persistent security threats, leading to reduced agricultural output and aggravated food insecurity.

Educational Level

The distribution of educational levels among farmers shows that 11.1% have no formal education, 19.4% completed primary education, 41.7% attained secondary education, and 27.8% reached tertiary education. These information suggest that a substantial majority (69.5%) of farmers possess at least a secondary school education, which is promising for the adoption of new agricultural practices and knowledge. However, the escalating insecurity in the region makes education even more critical. Educated farmers are generally more attuned to early warning signs, more likely to adopt risk-reducing strategies, and better positioned to access available support mechanisms (Abiodun, 2022). In contrast, those with limited or no formal education may encounter significant barriers when attempting to access government aid, insurance, or formal credit, especially in a context where insecurity further complicates access to resources.

The impact of insecurity on farmers extends beyond their ability to farm safely; it also limits their access to ongoing learning and institutional support. Educated farmers are more likely to engage in adaptive strategies such as crop diversification, cooperative formation, and digital access to markets and agricultural information, all of which are essential for survival in unstable environments. On the other hand, farmers with limited education may be more susceptible to misinformation, fear, and may ultimately abandon farming practices due to the psychological toll of insecurity, such as threats from banditry or land seizures. Bridging the educational gap and ensuring agricultural training programs are tailored to the realities of insecurity are crucial steps in fostering resilience and promoting equitable agricultural productivity in affected regions.

Primary Occupation

The study indicates that 86.1% of respondents identify farming as their primary occupation, with 11.1% engaged in trading and 2.8% employed as civil servants. This finding highlights the centrality of farming as the primary source of livelihood for the majority of respondents. Insecurity manifested through banditry, herder-farmer conflicts, and kidnappings directly threatens this livelihood base. When farmers, who form the predominant occupational group, are displaced or unable to access their farms safely, food production declines, and household incomes shrink. Unlike traders or civil servants, who may continue their activities with relatively less exposure to land-based threats, farmers are inherently tied to rural lands, making them disproportionately vulnerable to violence and instability.

Moreover, this occupational pattern highlights the limited livelihood diversification among respondents,

further increasing their exposure to risk in conflict-prone regions. The dominance of farming as the primary occupation means that disruptions to agricultural activities due to insecurity have cascading effects on household food security, local food systems, and market supply chains. Farmers are often forced to abandon fields during critical planting or harvesting seasons due to security threats, resulting in crop losses and discouragement from reinvesting in agriculture. As noted by Usman and Singh (2021), regions with a high reliance on agriculture are disproportionately affected by rural insecurity, especially in the absence of alternative employment opportunities. Therefore, policies aimed at promoting livelihood diversification, improving rural security infrastructure, and fostering community-based resilience strategies are essential for sustaining farming livelihoods and enhancing food security in Nigeria's conflict-prone areas.

Gender

The gender distribution analysis indicates that 71.7% of farmers are male, while 28.3% are female. This gender imbalance reflects the male-dominated nature of arable crop farming, especially in areas facing security challenges. Insecurity disproportionately discourages female participation in agriculture due to safety concerns, mobility restrictions, and heightened vulnerability to violence (Afolabi, 2022). Women are often deterred from farming in isolated or volatile areas, leading to a gendered imbalance in land use and food production. Furthermore, cultural norms in many rural communities restrict women's access to land or prevent them from independently managing farms, particularly in crisis-prone environments. Consequently, men remain dominant in agricultural activities, particularly in areas where physical presence, mobility, and risk-taking are required under hostile security conditions.

Despite their lower representation, women continue to play essential roles in food production, processing, and marketing. However, insecurity exacerbates the existing gender gap in access to agricultural resources and decision-making power. Female farmers are less likely to receive extension services or credit support in insecure environments, limiting their productivity and resilience. Moreover, insecurity restricts women's access to markets, educational programs, and cooperatives, thus limiting opportunities for economic empowerment. Addressing the gendered impacts of insecurity in agriculture is crucial for promoting inclusive rural development and ensuring food security.

Average Monthly Income

The study findings indicate that a significant proportion of farmers earn relatively low incomes, with 41.7% earning between ₦20,000 and ₦50,000, 25.0% earning between ₦50,001 and ₦100,000, and only 13.9% earning more than ₦100,000. Additionally, 19.4% of respondents earn less than ₦20,000 per month. These findings reflect the weak economic position of arable crop farmers in the region. The low income levels are directly linked to the adverse impacts of insecurity, which limit access to farmland, reduce labour availability, disrupt farming operations, and lead to post-harvest losses due to theft or displacement. Farmers in insecure zones often abandon their farms prematurely, harvest suboptimally, or suffer total losses due to violent attacks, resulting in significantly curtailed income generation and trapping many farmers in poverty. This situation discourages reinvestment in agriculture.

Insecurity further undermines the agricultural market environment, as buyers tend to avoid traveling to volatile areas, forcing farmers to sell their produce at reduced prices or incur additional costs to transport goods to safer markets. The psychological stress associated with farming in insecure zones also reduces productivity and discourages farmers from expanding their operations. Without economic security, farmers are less likely to adopt improved technologies or participate in formal financing schemes, as repayment becomes uncertain. Okwulu *et al*., (2024) highlight that persistent rural insecurity is a major constraint to income generation and livelihood sustainability for farmers. To achieve significant income improvements, integrated security interventions must be coupled with programs that enhance access to land, agricultural inputs, storage facilities, and secure market access, enabling farmers to operate in a stable and productive environment.

Table 1: Socioeconomic characteristics of arable crop farmers

Characteristic	Frequency	Percentage (%)
Age		
Below 25 years	10	2.8
25–34 years	70	19.4
35–44 years	138	38.3
45–54 years	118	32.8
65 years and above	24	6.7
Household Size		
1–3 members	50	13.9
4–6 members	120	33.3
7–9 members	110	30.6
10 and above	80	22.2

Characteristic	Frequency	Percentage (%)
Level of Education		
No formal education	40	11.1
Primary	70	19.4
Secondary	150	41.7
Tertiary	100	27.8
Primary Occupation		
Farming	310	86.1
Trading	40	11.1
Civil service	10	2.8
Gender		
Male	246	71.7
Female	102	28.3
Average Monthly Income		
Less than ₦20,000	70	19.4
₦20,000–₦50,000	150	41.7
₦50,001–₦100,000	90	25.0
Above ₦100,000	50	13.9

Source: Field Survey, 2025

Prevalence and Types of Insecurity Experienced by Arable Crop Farmers in North Central Nigeria

Theft of Crops or Farm Produce

Theft of crops or farm produce is the most prevalent form of insecurity, affecting 88.9% of respondents in North Central Nigeria. This type of insecurity occurs most frequently during the harvest season when farmers temporarily store their produce on farms before transporting it to markets. The perpetrators range from organized criminal gangs to opportunistic individuals, and in some cases, local residents involved in informal trade. The lack of effective policing, combined with weak postharvest infrastructure, creates an environment conducive to theft, which significantly disrupts the agricultural system. The high rates of theft make farmers reluctant to invest in long-term production or storage, as they are wary of losing their crops before they can realize any financial return. As Ata-Agboni *et al*., (2021) noted, this form of insecurity has become so pervasive that it significantly affects farmer morale and long-term planning.

The consequences of theft on food scarcity are profound. Farmers often resort to immediate sales at harvest time to avoid losses, which leads to a surplus of produce entering the market. However, this surplus often results in low prices for farmers, reducing their profitability and discouraging them from investing in future agricultural cycles. This leads to an unstable local food supply, with an overabundance of crops in the short term and a lack of produce during seasonal shortages. The threat of theft also discourages farmers from expanding production or diversifying crops, which weakens the resilience of the agricultural system in the long term. Smallholder farmers, who are particularly vulnerable due to limited resources for implementing security measures, face further challenges. In rural communities, this insecurity erodes social cohesion, particularly when the thieves are suspected to be neighbors or acquaintances. This breakdown of trust weakens communal policing efforts, leaving farmers increasingly isolated and unprotected. Effective solutions to address this issue include strengthening local farmer cooperatives, providing secure storage facilities, and establishing formal links between local law enforcement and farming communities to ensure better protection.

Destruction/Vandalism of Crops

Crop destruction and vandalism, affecting 76.4% of farmers, are primarily driven by intergroup conflicts, herder invasions, and political violence. In areas plagued by farmer-herder tensions, livestock are allowed to graze on farmland, destroying crops or rendering them unfit for harvest. In some cases, crops are intentionally burned as acts of revenge or land claims by herders or other hostile groups. This insecurity often escalates in regions with high ethnic, religious, or political tensions, leading to widespread destruction and displacement of farming households. According to Abunike & Chinyere (2024), crop destruction often peaks during preharvest periods, leading to total farm losses in extreme cases. Such destruction devastates household food supplies and exacerbates regional hunger.

The impact of crop destruction on food scarcity is significant. When farmers face crop destruction, they often resort to planting fast-maturing, low-value crops, leading to a decline in crop diversity and nutritional content. These changes not only affect the variety of food available in local markets but also hinder farmers' ability to generate sustainable income. The disruption of agricultural activities causes a general decline in food production, and communities that once depended on local food sources now face shortages. The psychological toll on farmers, who suffer trauma from

repeated vandalism, further discourages them from returning to their farmlands, worsening food scarcity.

Banditry and Armed Attacks on Farms

Banditry and armed attacks, affecting 69.4% of farmers, are a serious form of insecurity in North Central Nigeria. Armed groups invade farmlands to extort money, seize produce, or abduct farmers. These attacks often lead to the abandonment of farmlands as farmers fear for their safety and livelihoods. Dennis *et al*., (2022) documented how these violent acts have escalated to the point where many rural communities in northern Nigeria are left unproductive due to constant fear of attacks, with some areas designated as "no-go zones" for agricultural workers.

The immediate consequence of these attacks is the interruption of agricultural activities, as farmers either scale down their operations or flee the region entirely. This disruption leads to reduced food production, increased food prices, and diminished availability of food. Additionally, the weakening of the agricultural value chain, with agro-dealers, extension agents, and market participants avoiding affected areas due to safety concerns, exacerbates the situation. Rufus & Ogbe (2025) noted that a growing number of farmers are victims of abduction, extortion, and armed attacks, resulting in large-scale abandonment of farmland and increased rural-to-urban migration. The long-term effect of banditry on food scarcity is even more damaging. As armed groups impose illegal "harvest levies," farmers are forced to give up a portion of their income, leaving them with less capital to reinvest in the next farming cycle. This reduces the availability of resources for inputs such as seeds, fertilizers, and labour, further diminishing agricultural productivity. Fear of future attacks may also discourage the establishment of protective measures like secure storage or fencing, as farmers perceive such investments as futile.

Farmer-Herder Conflicts

Farmer-herder conflicts, affecting 68.1% of farmers, are a major driver of food insecurity in North Central Nigeria. These conflicts arise from competition over land and grazing resources, particularly in regions where both farmers and herders rely on the same land for their livelihoods. Ethnic and political tensions often exacerbate these disputes, leading to violent clashes and the displacement of farming households. Yamusa (2022) highlighted that such conflicts in Nigeria's Middle Belt have severely undermined agricultural productivity and land use stability. The direct consequence of these conflicts on food scarcity is a reduction in agricultural production. Farmers often abandon their lands or avoid cultivating disputed plots, leading to large areas of farmland being left uncultivated. This disruption reduces the overall food supply, causing food prices to rise.

Boko Haram Insurgency

The Boko Haram insurgency has had a profound impact on food security in North Central Nigeria, with 66.4% of farmers reporting direct effects on their farming operations. The insurgents target farming communities, destroying crops, stealing livestock, and instilling fear among residents, which leads to the abandonment of agricultural activities. Farmlands that once yielded essential crops, such as maize, cassava, and yams, are now abandoned or destroyed due to the threat of violence. The insurgency directly contributes to food scarcity by destroying the local food supply. Crops are destroyed or rendered inaccessible due to ongoing violence, and farmers are unable to replace their losses due to the lack of safety and security in these regions. Local communities face severe food shortages, and food prices increase significantly as demand exceeds supply. The insurgency's destruction of infrastructure, such as roads and storage facilities, further limits farmers' ability to transport goods to markets, worsening the situation. This finding is consistent with the work of Oladosu *et al*., (2025), who reported that insurgency undermined farmers' capacity to sustain food production, leading to a critical shortage in the supply of essential staple crops.

Kidnapping

Kidnapping, reported by 64.2% of farmers, has become a significant cause of farm abandonment and reduced agricultural productivity in North Central Nigeria. The fear of abduction has prompted farmers, especially those in remote or forested areas, to minimize their presence on their farms or completely cease farming activities. Many farmers are reluctant to venture into the fields, especially when their crops are mature and ready for harvest, due to the risk of being kidnapped. Ojima-Achimi *et al*., (2024) noted that the surge in abductions has significantly disrupted agricultural activities, particularly in agrarian regions. Similarly, Ayegbusi (2024) affirmed that farmer-targeted kidnappings have become a major disincentive to agricultural productivity in parts of Nigeria, leading to diminished food output and economic losses.

The impact of kidnapping on food scarcity is profound. As farmers abandon their land or reduce their farming activities due to the fear of abduction, agricultural production in the affected regions plummets. This leads to a reduction in the availability of local food supplies, with farmers unable to harvest or transport their produce to the market. Additionally, markets become less active as traders and other agricultural participants avoid traveling to high-risk areas. This disruption causes food prices to rise as the supply chain breaks down, further exacerbating food scarcity. In some cases, food scarcity leads to increased reliance on imported food, which not only raises costs but also weakens the self-sufficiency of local communities. The long-term consequences of kidnapping for food security are even more devastating. Fear of future abductions deters

farmers from making long-term investments in their farms, such as purchasing seeds, fertilizers, or equipment. This prevents farmers from increasing productivity and optimizing their land's potential.

Displacement

Displacement, affecting 63.6% of farmers, is another significant factor contributing to food insecurity in North Central Nigeria. Displacement occurs as a result of violent conflicts, land grabs, and communal unrest, which deprives farmers of their land and the ability to farm. Displaced farmers are often forced to leave their homes with little to no resources, making it difficult for them to restart farming in new locations. Egbule & Okonta (2024) emphasized that internal displacement has increasingly affected farming communities in Nigeria, leading to both the loss of livelihoods and heightened food insecurity. Displacement also disrupts farming cycles, as displaced individuals are often unable to farm in their new locations due to insecure land tenure, poor soil quality, or lack of agricultural support. According to George & Adelaja (2021), displacement has affected hundreds of farming households, many of whom have lost homes, tools, farmlands, and social networks, leading to long-term setbacks in food production and rural development.

The impact of displacement on food scarcity is significant. As farmers are uprooted from their land, they lose not only their crops but also their ability to produce food for themselves and their communities. In many cases, displaced farmers are forced to settle in urban slums or refugee camps, where they have little or no access to farmland. This increases their dependency on humanitarian aid, which is often insufficient to meet the growing food needs. Even when displaced farmers manage to find land in their new locations, insecure land tenure or limited access to resources such as water and fertilizers hampers their ability to farm effectively. The disruption in food production, combined with an influx of displaced people, results in a significant increase in food scarcity in both the displaced communities and host areas. The long-term consequences of displacement for food security are profound. Displaced farmers often face difficulties reintegrating into farming communities, particularly if they lack legal rights to the land they occupy. Furthermore, the repeated cycles of displacement make it increasingly difficult for farmers to rebuild their livelihoods and restore their farming activities. As a result, regions affected by displacement see a steady decline in agricultural productivity, leading to chronic food scarcity and food insecurity.

Natural Disasters

Natural disasters, such as floods, droughts, and irregular rainfall patterns, were reported by 58.3% of farmers as significant threats to their farming activities. These events, which have become more frequent and intense due to climate change, often lead to complete crop loss, soil erosion, and the destruction of farm infrastructure. Farmers in flood-prone areas, for instance, face the devastating effects of riverine flooding, while those in dryland areas struggle with extended droughts that leave crops unable to thrive. Balgah *et al*., (2023) noted the rising trend of climate-induced disasters affecting smallholder farmers, particularly those in vulnerable agricultural zones. These natural events not only damage crops but also disrupt planning and investment cycles, making it difficult for farmers to anticipate and recover from losses. Omokaro (2025) highlighted how these climatic events disrupt planting calendars, wash away farmlands, and destroy stored produce.

The consequences of natural disasters on food scarcity are immediate and long-lasting. Floods and droughts destroy crops, reduce yields, and wash away essential farming infrastructure such as irrigation systems and storage facilities. This results in a loss of food production, which causes price increases in local markets. The reduced availability of food leads to scarcity, particularly for perishable crops like vegetables and fruits. In the aftermath of natural disasters, farmers often struggle to rebuild their farms due to limited access to resources and support, further prolonging the scarcity of food. Additionally, the lack of reliable weather forecasting systems leaves farmers ill-prepared for these disasters, leading to further losses when disaster strikes unexpectedly. Over time, the impact of natural disasters can severely undermine food security in affected regions. As farmers are forced to abandon their fields or opt for low-risk, short-duration crops, overall agricultural output declines. The long-term damage to soil quality and infrastructure also reduces the potential for future food production. In areas with frequent natural disasters, the cycle of crop loss and recovery becomes unsustainable, leading to chronic food insecurity.

Postharvest Insecurity Issues

Postharvest insecurity, identified by 53.3% of farmers, encompasses the loss of harvested crops due to spoilage, pest infestation, theft during storage, and insecurity along transportation routes. In conflict-prone regions, the risk of theft during storage and transit increases as farmers are unable to secure their crops properly. Bappah & Adejoh (2024) reported that farmers in these areas face heightened risks during the postharvest period, especially due to the lack of reliable storage facilities and insecurity along market routes. The absence of secure storage options forces farmers to sell their crops immediately after harvest, often at unfavorable prices, to avoid losses due to spoilage or theft. This is consistent with Ogundele (2022) findings that postharvest insecurity is a serious challenge. Due to inadequate or unsafe storage options, many farmers are forced to sell their produce immediately after harvest, often at low prices. This shortens household food reserves and increases food scarcity during the dry season.

The impact of postharvest insecurity on food scarcity is significant, as it leads to the loss of marketable crops and reduced food supply. Farmers who are unable to store their produce properly face severe financial losses, as the cost of production cannot be recouped. The immediate sale of crops results in market surpluses, which temporarily lower prices but contribute to food scarcity in the long run when these crops cannot be stored for future consumption. The lack of infrastructure and insecurity along transport corridors further disrupts the flow of food to markets, leading to localized shortages. In some cases, this disrupts the entire supply chain, causing food prices to increase as demand remains high but supply is limited. The long-term consequences of postharvest insecurity on food scarcity are compounded by the reluctance of farmers to invest in future production. Fear of postharvest losses discourages farmers from adopting improved storage practices, purchasing appropriate storage facilities, or diversifying their crops. This lack of investment in postharvest management results in inefficiencies in the agricultural sector and reduces the resilience of food systems.

Economic Insecurity

Economic insecurity, reported by 48.9% of farmers, is driven by market price volatility, rising input costs, and unstable incomes. In regions affected by conflict or poor infrastructure, farmers face significant challenges in accessing reliable markets. Olanrewaju & Balana (2023) found that fluctuations in input costs, such as fertilizers and labour, make it difficult for farmers to plan and execute their farming activities. When input costs rise unexpectedly or market prices drop, farmers are forced to make difficult decisions, such as reducing the amount of land they cultivate or choosing lower-value crops. This economic uncertainty makes farming an increasingly risky and less profitable endeavor, contributing to food insecurity in the region. These changes severely affect farmers' ability to forecast production costs and profit margins, undermining confidence in agriculture as a reliable and sustainable livelihood (Iheke & Onyendi 2017).

The consequence of economic insecurity on food scarcity is multi-faceted. When farmers are unable to afford inputs, the quality and quantity of food production are directly affected. A reduction in the amount of land cultivated or the adoption of low-yield crops leads to a decrease in food supply, which exacerbates food scarcity. The uncertainty of income also means that farmers are unable to invest in expanding their operations or improving their farming practices, further limiting agricultural output. This results in food shortages, especially in regions where agriculture is the primary means of livelihood. Long-term economic insecurity exacerbates food scarcity by making it difficult for farmers to recover from losses. The lack of financial resources prevents farmers from purchasing necessary inputs for the next planting season, and the inability to project future income discourages investment in farm improvements. This cyclical nature of economic insecurity leads to low agricultural productivity and worsens food scarcity in rural areas.

Financial Insecurity

Financial insecurity, reported by 45.0% of farmers, stems from poor access to affordable credit, high input costs, and erratic income flows. Many farmers rely on informal savings groups or personal networks, which are often unreliable during periods of widespread insecurity. Sambo *et al*., (2025) highlighted that limited access to formal credit is a major barrier to agricultural development, especially for smallholder farmers. In insecure areas, this problem is compounded by the reluctance of financial institutions to extend loans in regions with high risks of theft, destruction, or violence. This lack of financial resources prevents farmers from purchasing necessary inputs, such as seeds, fertilizers, and equipment, which are crucial for maintaining or expanding their agricultural activities. As a result, they are often excluded from bank loans or cooperative funding, particularly in conflict-affected zones (Elum & Obiajunwa 2022).

The impact of financial insecurity on food scarcity is significant. Without access to credit or savings, farmers are unable to purchase the inputs they need to produce food, leading to lower yields and reduced food supply. The lack of financial resources also limits the ability of farmers to recover from crop failures or other setbacks, preventing them from reinvesting in their farms. This results in a decline in agricultural productivity, which directly contributes to food insecurity. Furthermore, when farmers are unable to purchase inputs, they may be forced to reduce the size of their farms or abandon farming altogether, further exacerbating food scarcity in the region. Long-term financial insecurity undermines the sustainability of agriculture, as farmers are discouraged from making investments that could increase productivity and reduce food scarcity. This results in a vicious cycle of poverty and food insecurity, where farmers are unable to escape their economic challenges and are forced to rely on external aid.

Land Disputes or Encroachment Issues

Land disputes or encroachment issues, reported by 43.1% of farmers, are particularly prevalent in regions where land tenure systems are informal and lack proper documentation. These disputes often arise from ethnic tensions, family disagreements, and competition for resources, and they can result in the forced eviction of farmers from their land. Sunday (2021) and Oluwatayo *et al.,* (2019) highlighted how weak land governance contributes to recurring land conflicts, which are exacerbated by the expansion of agricultural land and population growth. The inability to resolve land disputes often leads to farmers abandoning contested plots or reducing the size of their operations, which reduces agricultural productivity.

The consequences of land-related insecurity on food scarcity are significant. When farmers are displaced from their land or unable to cultivate contested plots, the land remains underutilized, leading to a reduction in food production. The lack of secure land tenure also discourages farmers from making long-term investments, such as planting perennial crops, building infrastructure, or conserving soil quality. As a result, food production becomes unstable, and food prices increase due to reduced supply. In some cases, land disputes also lead to the destruction of crops, further deepening food scarcity in the affected areas.

Market-Related Insecurity

Market-related insecurity, affecting 35.6% of farmers, arises from issues such as blocked access to markets, extortion at roadblocks, absence of buyers, and exploitative pricing practices. In conflict-prone regions, insecurity along transportation routes makes it difficult for traders and market participants to access rural farming areas, forcing farmers to sell locally at deflated prices. Oladoyin *et al*., (2024) documented the significant disruptions in market linkages caused by insecurity, highlighting how roadblocks and unsafe routes prevent farmers from reaching broader markets. As a result, farmers are unable to sell their produce at competitive prices, which significantly impacts their income and profitability.

The impact of market insecurity on food scarcity is direct and substantial. When farmers are unable to access markets or are forced to sell their produce locally at low prices, it reduces their financial resources, which are necessary for reinvestment in farming. This discourages future production and creates an environment of unpredictability in the food supply chain. The lack of reliable market access also leads to seasonal food surpluses followed by shortages, as farmers are unable to store or transport their produce effectively. As food availability fluctuates, food prices become volatile, exacerbating food insecurity for both producers and consumers. The long-term effects of market-related insecurity on food scarcity include reduced agricultural innovation and investment. Farmers are less likely to diversify their crops or scale up production when they cannot reliably sell their produce at fair prices. Additionally, the exploitation of farmers by intermediaries who take advantage of their limited market options weakens trust in the agricultural system.

Table 2: Prevalence and types of insecurity experienced by arable crop farmers

Insecurity Type	Frequency	Percentage (%)	Rank Order (Prevalence)
Theft of crops or farm produce	320	88.9	1st
Destruction/vandalism of crops	275	76.4	2nd
Banditry and armed attacks on your farm	250	69.4	3rd
Farmer-herder conflicts	245	68.1	4th
Boko Haram insurgency	239	66.4	5th
Kidnapping	231	64.2	6th
Displacement	229	63.6	7th
Natural disasters (e.g., floods, droughts)	210	58.3	8th
Post-harvest insecurity issues	192	53.3	9th
Economic insecurity (e.g., market price volatility)	176	48.9	10th
Financial insecurity (e.g., access to credit)	162	45.0	11th
Land disputes or encroachment issues	155	43.1	12th
Market-related insecurity	128	35.6	13th

Source: Field Data, 2025

Food Scarcity Levels Among Respondents

The results indicate a significant prevalence of food scarcity among the respondents over the past year. Specifically, 27.8% of households experienced moderate food scarcity, 33.3% reported high levels of scarcity, and 13.9% faced severe food insecurity. In total, 74.9% of respondents encountered moderate to severe food shortages during the 12-month period. This highlights a critical gap in food access for rural farmers in the region, suggesting that food insecurity is not a transient issue but a systemic one. The observed prevalence of food shortages can be attributed to several insecurities impacting agricultural productivity, including conflict, economic hardship, displacement, crop destruction, and limited access to essential farm inputs and markets. These factors disrupt agricultural cycles and reduce the capacity of households to produce sufficient food. The extent of food scarcity reported reflects not merely short-term hardship but a deeper, structural failure within local food systems. Remarkably, only 8.3% of respondents reported no food scarcity during this period, further emphasizing that consistent food availability remains a substantial challenge for the majority of the population. Similar findings were noted by Olanrewaju & Balana (2023), who observed high levels of food insecurity in agrarian communities facing severe disruptions to their livelihoods.

In alignment with these findings, food insecurity has been shown to significantly impact household dynamics. A significant proportion (27.8%) of respondents reported that they never had to skip meals

due to a lack of food, suggesting that these households may have more stable incomes, effective food storage systems, or resilient agricultural practices. Such households may also benefit from better access to productive resources, stable market access, or targeted food security interventions. However, these households represent a minority of the sample population. In contrast, only 25.0% reported rarely skipping meals, while 22.2% sometimes skipped meals, 13.9% frequently skipped meals, and 11.1% always skipped meals. This pattern suggests that 47.2% of respondents experienced moderate to severe food insecurity. Households in this category face chronic food shortages, placing them at a heightened risk of malnutrition, particularly among vulnerable groups such as children and the elderly. This finding is particularly concerning, as it highlights the profound effects of insecurity on food access and indicates a breakdown in household food provisioning systems. Chronic meal skipping has far-reaching implications for health, productivity, and school attendance. As noted by Sadiq *et al*., (2024), insecurity undermines agricultural production and destabilizes food supply chains, exacerbating household vulnerability.

The result also reveal troubling patterns in household food consumption, which are directly linked to supply shortages. Only 8.3% of respondents indicated that they never reduced the variety of foods they consumed, implying that only a small fraction of households enjoy stable food access. In contrast, 16.7% reported rarely reducing food variety, suggesting mild disruptions that could worsen under economic or security stress. However, a significantly larger proportion of respondents, specifically 16.7% sometimes, 27.8% frequently, and 30.6% always reduced food variety. This indicates that 75.1% of households are experiencing moderate to severe food insecurity, as they are forced to limit the diversity of their diets, an essential aspect of maintaining adequate nutrition and overall health. The reduction in food variety is commonly employed as a coping mechanism in food-insecure households, reflecting chronic shortages that could lead to malnutrition, particularly among children and other vulnerable individuals. The widespread occurrence of this behavior underscores the detrimental effects of food supply instability and insecurity on household food systems. As Adekunle *et al*., (2024) highlighted, insecurity disrupts both agricultural production and market access, directly diminishing food availability and diversity at the household level.

Financial constraints also appear as a significant barrier to food access. Only 5.6% of respondents reported that they never encountered difficulties in purchasing sufficient food due to financial limitations, signaling a very small proportion of households with stable purchasing power. Another 11.1% reported rarely facing such difficulties, indicating minimal vulnerability. However, the majority of households, totaling 83.3%, faced more severe financial challenges: 22.2% sometimes struggled to afford food, 27.8% frequently encountered difficulties, and 33.3% always faced such challenges. This widespread financial insecurity places households at risk of hunger, poor nutrition, and deteriorating well-being, particularly for vulnerable groups such as children and the elderly. The inability to afford sufficient food is a clear indicator of poverty and chronic deprivation, which, when experienced consistently, severely undermines household resilience. As Amadi-Robert *et al*., (2024) observed, insecurity and economic shocks contribute to a decline in agricultural productivity and household income, diminishing the ability of families to meet their basic food needs and maintain a healthy diet.

Table 3: Food scarcity level of respondents

Food Scarcity Statement	Frequency	Percentage
In the past 12 months, how often has your household experienced a shortage of food?		
No food scarcity (1.0–1.9)	30	8.3
Low scarcity (2.0–2.9)	60	16.7
Moderate scarcity (3.0–3.9)	100	27.8
High scarcity (4.0–4.5)	120	33.3
Severe scarcity (4.6–5.0)	50	13.9
How frequently does your household have to skip meals due to lack of food?		
Never	100	27.8
Rarely	90	25.0
Sometimes	80	22.2
Frequently	50	13.9
Always	40	11.1
How often does your household reduce the variety of food available due to shortage of supplies?		
Never	30	8.3
Rarely	60	16.7
Sometimes	60	16.7
Frequently	100	27.8
Always	110	30.6

Food Scarcity Statement	Frequency	Percentage
How often has your household been unable to buy sufficient food due to financial constraints?		
Never	20	5.6
Rarely	40	11.1
Sometimes	80	22.2
Frequently	100	27.8
Always	120	33.3

Source: Field survey, 2024

Household Average Monthly Income Before and During Insecurity

The result presented in Table 4 reveals a significant shift in household income levels before and during the period of insecurity. Prior to the onset of insecurity, a substantial proportion of households earned above ₦50,000 monthly, with 35.8% of households earning between ₦50,001 and ₦100,000, and 28.3% earning in excess of ₦100,000. In contrast, only 8.9% of households reported earnings below ₦20,000, while 26.9% earned between ₦20,000 and ₦50,000. However, the onset of insecurity led to a stark reversal in income distribution: during the period of insecurity, 23.3% of households now report earnings below ₦20,000, with 43.3% of households earning within the ₦20,000–₦50,000 range. The proportion of households earning between ₦50,001 and ₦100,000 has significantly decreased to 20.8%, and only 12.5% of households now earn above ₦100,000.

This income shift reflects a systematic erosion of household income, which can be directly attributed to the multidimensional impacts of insecurity. Disruptions to agricultural activities—exacerbated by restricted access to farmland and the destruction of market infrastructure—have led to reduced agricultural yields and increased production costs. Losses from theft and abandoned harvests have further aggravated the decline in household income. Households that previously earned higher income levels have witnessed a marked reduction in productivity, with many reducing or abandoning agricultural activities altogether. Consequently, these households have descended into lower income brackets, with many adopting subsistence farming or informal labour as survival strategies. This contraction in income severely limits their capacity to invest in critical agricultural inputs, labour, or the adoption of improved technologies—all of which are essential for sustaining agricultural productivity and promoting broader economic resilience.

The implications of these shifts are profound and far-reaching. With the majority of households now earning below ₦50,000, there is an amplified threat to food security and overall household welfare. This income reduction represents not only a direct challenge to individual livelihoods but also signals a broader weakening of purchasing power within rural economies. In turn, this undermines local markets and stymies community development. Insecurity, therefore, transcends its impact on individual farmers, representing a systemic disruption to the rural economic framework. As highlighted by Ndubueze-Ogaraku *et al*., (2017), the prolonged income losses resulting from insecurity lead to a weakening of farmers' economic resilience, diminishing their ability to recover from setbacks. This erosion of recovery capacity heightens the vulnerability of affected households to deepening poverty and food insecurity.

Given the magnitude and scope of these observed income shifts, it is clear that immediate and sustained policy intervention is necessary to mitigate the socio-economic fallout of insecurity. Restoring security and creating an environment conducive to agricultural recovery is paramount to ensuring the long-term resilience of affected communities. Strategic interventions should include the rehabilitation of market infrastructure, enhanced access to credit, and the promotion of sustainable agricultural practices.

Table 4: Household average monthly income before and during insecurity

Income Level	Before Insecurity	% Before	During Insecurity	% During
Less than ₦20,000	32	8.9	84	23.3
₦20,000 – ₦50,000	97	26.9	156	43.3
₦50,001 – ₦100,000	129	35.8	75	20.8
Above ₦100,000	102	28.3	45	12.5
Total	**360**	**100.0**	**360**	**100.0**

Source: Field survey, 2024

Household Average Monthly Food Expenditure Before and During Insecurity

The result presented in Table 5 reveals a significant shift in household food expenditure patterns before and during the period of insecurity. Prior to the onset of insecurity, the majority of households (38.9%) allocated between ₦40,001 and ₦70,000 monthly on food, followed by 28.3% of households who spent

between ₦20,000 and ₦40,000. A smaller proportion, 17.2%, spent between ₦70,001 and ₦100,000, while only 7.2% of households spent above ₦100,000. However, during the period of insecurity, a marked shift in expenditure occurred, with 35.6% of households now spending between ₦70,001 and ₦100,000, and 23.3% reporting expenditures above ₦100,000. Conversely, the proportion of households spending ₦40,001 and ₦70,000 decreased to 25.0%, while the proportion spending less than ₦40,000 sharply declined to 12.8% (spending between ₦20,000 and ₦40,000) and 3.3% (spending below ₦20,000), respectively.

The upward shift in food expenditure during insecurity, particularly the substantial rise in households spending more than ₦70,000, suggests that insecurity has led to an increase in food costs and significant disruptions in local market supply chains. Constrained access to farmlands, reduced agricultural production, and heightened transportation risks are likely factors contributing to food scarcity and inflation, thereby forcing households to allocate more resources to meet their basic food needs. This increase in food-related expenditures, while not indicative of improved consumption or dietary diversity, likely reflects a survival response in an increasingly strained food economy. Abdulazeez and Hamidu (2022) assert that insecurity typically results in the collapse of food systems, driving up food prices and exacerbating the financial strain on household budgets.

The implications of these expenditure shifts are deeply concerning for both household welfare and broader food security. As food prices rise and availability becomes increasingly limited, vulnerable households may be compelled to reduce either the quantity or quality of their food intake, heightening the risk of malnutrition or undernourishment. Furthermore, the increased expenditure on food could force households to reallocate funds from other critical needs, including healthcare, education, and agricultural investment. This pattern reflects not only a financial burden but also a structural challenge tied to the compounded effects of insecurity on agricultural production, food distribution networks, and broader economic stability. If left unaddressed, the continued rise in food costs amidst persistent insecurity may exacerbate poverty and hunger, further destabilizing affected communities.

Table 5: Household Average Monthly Food Expenditure Before and During Insecurity

Expenditure Level	Before Insecurity	% Before	During Insecurity	% During
Less than ₦20,000	30	8.3	12	3.3
₦20,000 – ₦40,000	102	28.3	46	12.8
₦40,001 – ₦70,000	140	38.9	90	25.0
₦70,001 – ₦100,000	62	17.2	128	35.6
Above ₦100,000	26	7.2	84	23.3
Total	360	100.0	360	100.0

Source: Field survey, 2024

Effect of Types of Insecurity on Quantity of Food Produced Before Insecurity

The regression analysis shows that the model explains 63% of the variability in food production before insecurity, with an R-squared value of 0.63. The F-ratio of 34.30 and a p-value of 0.000 confirm the statistical significance of the model, indicating that at least one predictor variable is significantly related to food production. Additionally, the Variance Inflation Factor (VIF) values are below 10, suggesting no issues with multicollinearity, thereby ensuring the reliability of the regression estimates.

Climate Change Insecurity

Climate change has emerged as a profound challenge to agricultural productivity, particularly in regions that heavily depend on climate-sensitive sectors like agriculture. The coefficient for climate change insecurity in this study is -0.35, with a p-value of 0.004, signifying a statistically significant negative relationship between climate change and food production. Extreme weather events, such as droughts, floods, and temperature fluctuations, are becoming more frequent and severe as a result of climate change, leading to unpredictable growing seasons and diminished crop yields. In sub-Saharan Africa, where agriculture is predominantly rain-fed, the impacts of climate change are especially severe. As noted by Prince *et al*., (2023), increasing weather variability directly reduces crop yields and the availability of water resources essential for farming, contributing to heightened economic instability and diminishing farmers' livelihoods.

In Nigeria, where agricultural productivity is deeply tied to seasonal rainfall patterns, the effects of climate change are becoming more pronounced. Erratic rainfall patterns, prolonged dry spells, and extreme weather events like floods have significantly undermined crop growth, resulting in sharp declines in yields. Moreover, these climatic disturbances lead to extensive damage to agricultural infrastructure, such as fields, irrigation systems, and storage facilities. This environmental instability fosters uncertainty among farmers, which discourages long-term investments in agriculture and reduces the overall resilience of the agricultural sector.

Postharvest Insecurity

Postharvest insecurity is a critical concern that significantly impedes food production, particularly in

regions where agricultural infrastructure is underdeveloped. The coefficient for postharvest insecurity in this study is -1.50, with a p-value of 0.047, signifying a statistically significant negative relationship between postharvest losses and food production. Postharvest insecurity is driven by several factors, including inadequate storage facilities, pest infestations, and theft, which result in the spoilage or loss of crops before they can be consumed or sold. Globally, postharvest losses are a substantial concern, with studies indicating that roughly one-third of food produced is lost after harvest, a large portion of which occurs during postharvest handling. In regions like Africa, where farmers often lack access to modern storage facilities and efficient transportation networks, postharvest losses are particularly detrimental. Ogundele (2022) emphasizes that improving storage and postharvest handling practices is critical to curbing these losses and preventing negative impacts on food security.

Postharvest insecurity presents a significant challenge due to poor storage infrastructure and the inefficiencies of existing supply chains. Farmers frequently rely on rudimentary storage methods that fail to protect crops from spoilage, pest damage, or theft, resulting in substantial losses of their harvests. Furthermore, limited transportation networks make it difficult for farmers to deliver their produce to markets in a timely manner, exacerbating postharvest losses. The findings of this study underscore the urgent need to address postharvest insecurity by investing in improved storage technologies, enhancing transportation infrastructure, and expanding market access for farmers.

Household Size

Household size has a statistically significant positive effect on food production, with a coefficient of 0.65 and a p-value of 0.010, suggesting that larger households are more likely to produce higher quantities of food. This positive relationship indicates that larger households can mobilize more labour for agricultural activities, leading to increased productivity. A larger pool of family labour facilitates tasks such as planting, weeding, harvesting, and postharvest processing, which are vital to maintaining and increasing agricultural output. This finding aligns with studies on household dynamics, such as Adamu *et al*., (2021), who emphasize that family labour plays a crucial role in boosting agricultural productivity, especially in resource-constrained environments where external labour may be limited or costly. The presence of multiple household members provides the necessary workforce to expand farming activities, thereby enhancing the overall production capacity.

However, while larger households typically experience increased food production, they may also face challenges related to food distribution and resource allocation. In some cases, larger families struggle with equitable distribution of food and resources, especially when agricultural yields are low or labour resources become overstretched. The demand for food, fuel, and other essentials may exceed the available supply, leading to disparities in consumption and nutrition within the household. Despite these challenges, the overall effect of household size on food production remains positive, reinforcing the idea that increased labour availability can significantly enhance agricultural output.

Vandalism

Vandalism, with a coefficient of -2.00 and a p-value of 0.046, demonstrates a significant negative relationship with food production. In this context, vandalism refers to the deliberate destruction of agricultural assets, including the theft of farm equipment, damage to crops, and sabotage of infrastructure. This study highlights the disruptive impact of criminal activities on farmers' ability to maintain or increase food production. As Abunike & Chinyere (2024) suggest, criminal acts like vandalism are particularly damaging in agricultural communities where infrastructure and farm equipment are essential for sustaining productivity. In Nigeria, incidents of vandalism have become increasingly prevalent, targeting irrigation systems, farm equipment, and storage facilities, which are necessary for effective agricultural operations. These acts lead to substantial financial losses for farmers and disrupt the normal flow of farming activities, resulting in lower agricultural output.

The negative relationship between vandalism and food production emphasizes the need for policy interventions aimed at addressing the root causes of criminal activities affecting farming communities. Without addressing these challenges, the agricultural sector will continue to suffer from reduced productivity, thereby undermining efforts to achieve food security.

Banditry

Banditry, with a coefficient of -3.50 and a p-value of 0.005, demonstrates a strong negative relationship with food production, highlighting the severe impact of armed robbery, extortion, and other forms of violence on agricultural productivity. Banditry creates an atmosphere of insecurity that disrupts farming activities, leading to reduced yields and significant losses in agricultural output. As Olanrewaju *et al*., (2024) note, banditry has become widespread in rural Nigeria, with farmers frequently targeted by criminal groups that steal crops, livestock, and agricultural tools, and sometimes even harm the farmers themselves. The pervasive atmosphere of fear and uncertainty generated by banditry discourages farmers from making investments in their land and farming practices, ultimately causing many to abandon their farms. This abandonment further exacerbates food insecurity, contributing to long-term reductions in food production.

The strong negative relationship observed between banditry and food production suggests that

addressing the root causes of criminal violence is crucial for restoring agricultural productivity in affected areas. Without these interventions, banditry will continue to undermine agricultural activities, leading to a decline in food security and negatively impacting the livelihoods of farmers in rural communities.

Farmer/Herder Conflict

Farmer/herder conflict, with a coefficient of -4.00 and a p-value of 0.008, demonstrates a statistically significant negative impact on food production. The conflict, primarily driven by competition for land and water resources between farmers and herders, has a destructive effect on agricultural productivity. Violent clashes between the two groups often result in the destruction of crops, livestock, and farming infrastructure, further exacerbating food insecurity in the region. As Udosen (2021) suggests, these conflicts have become increasingly frequent and violent in Nigeria, where agriculture plays a vital role in the economy. The violence associated with farmer/herder conflicts forces many farmers to abandon their land or reduce production, which directly decreases the overall food supply. The ongoing insecurity and destruction of resources hinder farmers' ability to engage in productive agricultural activities, leading to long-term declines in food production.

The coefficient for farmer/herder conflict underscores the urgent need for conflict resolution mechanisms and policy interventions that address the root causes of this ongoing conflict. Without effective intervention, the farmer/herder conflicts will continue to diminish agricultural output, contributing to sustained food insecurity in affected areas.

Boko Haram Insurgency

The coefficient for Boko Haram insurgency is -2.80, with a p-value of 0.032, indicating a significant negative relationship between the insurgency and food production in North Central Nigeria. The Boko Haram insurgency, which includes violent attacks on villages, destruction of crops, livestock theft, and bombings, has led to widespread disruption in agricultural activities. As Adekunle *et al*., (2024) highlight, the insurgency has caused large-scale displacement of farmers, the destruction of agricultural infrastructure, and the creation of an atmosphere of fear, all of which undermine food production. Farmers in affected regions are often forced to abandon their lands, resulting in reduced food availability and contributing to increasing food scarcity in the area.

The insurgency's significant impact on food production underscores the need for targeted policy responses to restore stability and support agricultural recovery. Efforts should focus on providing security for displaced farmers, rebuilding agricultural infrastructure, and ensuring access to necessary resources such as seeds, fertilizers, and tools.

Economic Insecurity

Economic insecurity, with a coefficient of -1.20 and a p-value of 0.008, demonstrates a significant negative relationship with food production. Economic insecurity, which includes factors such as inflation, unemployment, and income fluctuations, severely restricts farmers' ability to invest in critical agricultural inputs. When farmers face economic hardship, they are often unable to afford seeds, fertilizers, and equipment necessary for efficient food production. This lack of investment directly impacts agricultural output, as farmers are unable to maintain or expand their operations. Economic instability also fosters an environment of uncertainty, making it difficult for farmers to plan for the future, which exacerbates food insecurity in the community. These findings align with studies by Akinde & Adekunle (2024), which emphasize the detrimental effects of economic instability on agricultural investment and productivity.

In regions like Nigeria, where many smallholder farmers rely on subsistence agriculture, economic insecurity becomes a significant barrier to improving productivity. The inability to access essential inputs prevents farmers from adopting new technologies or practices that could enhance yields. Furthermore, economic insecurity reduces access to labour, as farmers may not afford to hire additional workers during peak agricultural periods. As farmers struggle with economic challenges, food production diminishes, which not only affects household incomes but also contributes to broader food insecurity in rural areas. Addressing the root causes of economic insecurity, such as creating jobs, and providing social safety nets for farmers, is essential for enhancing food security in the long run.

Financial Insecurity

Financial insecurity, with a coefficient of -0.90 and a p-value of 0.072, suggests a marginally negative relationship with food production. Although this result is not statistically significant at the 5% level, the negative coefficient indicates that a lack of financial resources may limit farmers' ability to invest in agricultural activities and improve productivity. This finding aligns with research by Nasereldin *et al*., (2023), which underscores the importance of access to credit and financial resources for enhancing agricultural production. Financial insecurity may prevent farmers from purchasing necessary inputs, such as seeds, fertilizers, or mechanized equipment that could improve farm efficiency and yield. Where access to formal financial services is often limited, financial insecurity can prevent farmers from capitalizing on opportunities to enhance production. Farmers may be forced to rely on informal sources of finance, such as loans from family members or moneylenders, which often come with high-interest rates or unfavorable terms. This lack of access to affordable credit reduces the capacity of farmers to invest in essential technologies, such as irrigation systems, machinery, or improved seed varieties. While not

statistically significant, addressing financial insecurity through policies that improve access to credit, insurance, and financial literacy could alleviate some of the constraints faced by farmers and enhance agricultural productivity in the long run.

Income Level

The coefficient for income level is 0.80, with a p-value of 0.024, indicating a positive and statistically significant relationship with food production. Higher income levels are associated with greater agricultural investment, as wealthier households can afford essential inputs, such as seeds, fertilizers, and modern farming equipment. These inputs contribute to higher productivity, as wealthier farmers are better equipped to implement efficient farming practices. The positive relationship between income and food production is consistent with the work of Osinubi & Apanisile (2021), who argue that wealthier farmers are more likely to invest in technologies that improve productivity and mitigate the effects of economic shocks, such as crop failures or fluctuating market prices.

Wealthier farmers are better positioned to invest in land improvement initiatives, such as enhancing soil fertility or installing irrigation systems, which significantly boost crop yields. Moreover, higher-income farmers are more likely to diversify their agricultural activities, investing in high-value crops or livestock, which can increase both food security and household income. This capacity for diversification and investment increases the resilience of food production systems, ensuring a reliable food supply even during periods of economic or environmental stress.

Access to Technology

Access to agricultural technology has a significant positive effect on food production, with a coefficient of 2.00 and a p-value of 0.013. This result underscores the transformative role of technology in boosting agricultural productivity. Farmers who have access to advanced agricultural technologies, such as hybrid seeds, mechanized equipment, and irrigation systems, are better positioned to increase their yields and improve production efficiency. These technologies reduce the reliance on manual labour, accelerate farming processes, and help mitigate the effects of pests, diseases, and climate change. The positive relationship between technology access and food production aligns with studies on agricultural development, which show how innovations in farming practices can lead to increased output, greater resilience, and more sustainable farming systems. In regions like Nigeria, where many farmers face barriers to accessing modern agricultural technologies, the adoption of new innovations can provide significant benefits. Farmers who are able to invest in or gain access to modern equipment, such as tractors and irrigation systems, can boost productivity while reducing labour costs and the time spent on cultivation. However, challenges related to affordability and access to such technologies remain, particularly in rural areas.

Access to Extension Services

The coefficient for access to extension services is 1.50, with a p-value of 0.097, indicating a positive relationship with food production, though the statistical significance is moderate. Extension services play a vital role in enhancing farmers' knowledge and equipping them with the skills and information necessary to adopt best agricultural practices, manage pests, and optimize new technologies. These services also support farmers in postharvest management and market access, all of which are crucial for improving agricultural outcomes. Although the p-value is slightly above the conventional threshold of 0.05, the positive relationship between extension services and food production suggests that they significantly contribute to food security by increasing agricultural productivity. In Nigeria, where agricultural extension services are often underfunded and understaffed, their effectiveness may be compromised. However, in areas where extension services are available, they provide invaluable support to farmers, helping them make informed decisions and improve crop management. Extension workers provide training on sustainable farming practices, pest management, and soil health, all of which contribute to higher yields. By investing in extension services, governments can empower farmers to enhance their productivity, bolster food security, and strengthen rural economies.

Table 6: Effect of types of insecurity on quantity of food produced before insecurity

Variable	Coefficient (β)	Standard Error	t-Statistic	p-value	VIF
Intercept (β0)	10.15	2.45	4.14	0.000	
Climate Change	-0.35	0.12	-2.92	0.004	1.10
Postharvest Insecurity	-1.50	0.75	-2.00	0.047	1.25
Household Size	0.65	0.25	2.60	0.010	1.12
Vandalism	-2.00	1.00	-2.00	0.046	1.20
Banditry	-3.50	1.25	-2.80	0.005	1.30
Farmer/Herder Conflict	-4.00	1.50	-2.67	0.008	1.15
Boko haram insurgency	-2.80	1.30	-2.15	0.032	1.22
Economic Insecurity	-1.20	0.45	-2.67	0.008	1.18
Financial Insecurity	-0.90	0.50	-1.80	0.072	1.33
Income Level	0.80	0.35	2.29	0.024	1.10

Access to Technology	2.00	0.80	2.50	0.013	1.25
Access to Extension Services	1.50	0.90	1.67	0.097	1.40
Market Accessibility	1.20	0.60	2.00	0.046	1.17
Security Forces and Protection	3.00	1.20	2.50	0.013	1.08
Land Tenure Security	2.50	1.00	2.50	0.013	1.12
R-Square	0.63				
F-ratio	34.30			0.000	

Source: Field survey, 2024

Effect of Types of Insecurity on Quantity of Food Produced During Insecurity

The model's R-squared value of was 0.70 indicates that 70% of the variability in food production during periods of insecurity can be explained by the selected variables with F-ratio of 46.73 and a p-value of 0.000, confirming statistical significance. The remaining 30% of variability can be attributed to other unmeasured factors. The VIF values, ranging from 1.70 to 2.60, which are relatively low, suggesting that there is no significant multicollinearity problem among the predictors

Climate Change

The coefficient of -0.45 indicates a significant negative effect of climate change on food production, with a p-value of 0.013 confirming its statistical significance. Climate change influences agricultural productivity through various channels, including rising temperatures, changing rainfall patterns, and an increase in extreme weather events such as droughts and floods. These shifts in climate conditions can disrupt traditional farming cycles, resulting in reduced crop yields and increased uncertainty about future agricultural output. As global temperatures rise, farmers in developing countries face heightened challenges in maintaining stable agricultural practices, especially in regions where crop production is highly dependent on specific climatic conditions. For instance, crop varieties that are adapted to particular temperature ranges may fail to thrive as temperatures increase beyond their tolerance limits, leading to decreased productivity.

The negative coefficient of -0.45 further suggests that even small, incremental shifts in climate variables can significantly undermine food security, particularly in vulnerable regions. For example, prolonged droughts can reduce water availability for irrigation, resulting in the failure of staple crops such as maize and rice. Similarly, erratic rainfall patterns can lead to crop failure, as either excessive rain causes flooding, or inadequate rain leads to drought stress. These climate-induced disruptions are not only detrimental to crop production but also to livestock farming, as changes in vegetation and water availability affect grazing conditions. Onyeneke *et al*., (2024) argue that the projected reduction in agricultural yields due to climate change may lead to increased competition for resources, exacerbating food insecurity.

Postharvest Insecurity

The coefficient of -2.00 reveals the substantial negative impact of postharvest insecurity on food production, with a p-value of 0.036 confirming the statistical significance of this effect. Postharvest losses, which result from factors such as spoilage, pest infestations, inadequate storage, and transportation challenges, represent a significant barrier to improving food security in agricultural regions. These losses can amount to a considerable portion of total agricultural production, especially in developing countries where the infrastructure for food storage and distribution is often underdeveloped. The loss of food after harvest not only reduces the quantity of food available for consumption but also increases the cost of food, as the remaining supply must be redistributed or supplemented by imports. Furthermore, postharvest insecurity can undermine farmers' willingness to invest in farming, as the risk of loss due to inadequate storage systems may deter them from expanding their operations or investing in higher-quality produce.

A critical factor contributing to postharvest insecurity is the absence of effective postharvest management practices. In regions where farmers lack access to modern storage facilities and transportation networks, the shelf life of perishable goods such as fruits, vegetables, and grains is significantly reduced. Moreover, conflict-related disruptions such as theft, arson, and the destruction of storage infrastructure further exacerbate the issue. Bappah & Adejoh (2024) highlight that poor infrastructure for food preservation and transportation results in large-scale losses, which can undermine entire agricultural value chains. Additionally, postharvest insecurity not only affects food availability but also poses economic consequences for farmers, as the loss of crops translates into financial hardship.

Household Size

The positive coefficient of 0.50 suggests that larger households tend to produce more food, likely due to the availability of more labour for agricultural tasks. With a statistically significant p-value of 0.013, this relationship underscores the importance of household size as a determinant of agricultural productivity, particularly in subsistence farming contexts where labour availability is a critical factor. Larger households have the capacity to engage in more intensive farming activities, such as planting, weeding, and harvesting, which can lead to higher crop yields. This dynamic is especially important in rural areas where mechanized

farming is less common, and labour-intensive practices are still prevalent. Additionally, larger households may have more diversified agricultural activities, such as cultivating different crops or raising livestock, which can help buffer the risks associated with food insecurity.

However, the positive effect of household size on food production is not without its limitations. While a larger household may provide more hands for agricultural labour, the economic and social structure of the household can influence the effectiveness of this labour. For example, if a household has a high dependency ratio, where a significant proportion of its members are not of working age or unable to contribute to farming activities, the additional labour may not be as beneficial. Ogunniyi *et al*., (2021) found that larger households are more likely to sustain farming activities, but this benefit is often offset if the household lacks access to sufficient land, capital, or other resources. Additionally, the relationship between household size and food production is complex and context-dependent. In areas where resources are scarce, larger households may face challenges in managing limited land and inputs effectively.

Vandalism

The coefficient of -1.80 points to the significant negative effect of vandalism on food production, with a p-value of 0.047 confirming its statistical significance. Vandalism in agricultural contexts includes acts such as the destruction of crops, sabotage of irrigation systems, theft of farming tools, and attacks on storage facilities, all of which reduce farmers' productive capacity. These acts of destruction are often more prevalent in regions marked by political instability, armed conflict, or social unrest, where weak law enforcement mechanisms and inadequate security infrastructure leave agricultural areas vulnerable to attacks. The destruction of valuable farming assets, such as irrigation systems and storage facilities, not only disrupts the immediate food supply but also hinders farmers' ability to plan for future agricultural cycles. The fear of vandalism can lead to long-term disinvestment in agricultural activities, as farmers may choose to abandon their land or reduce their agricultural investments due to the high risks of destruction.

Moreover, vandalism contributes to the erosion of farmers' confidence and their willingness to invest in improved farming techniques or technologies. In regions where acts of vandalism are frequent, farmers may refrain from adopting new practices, such as the use of high-quality seeds or advanced irrigation methods, for fear that these investments will be lost to theft or destruction. Audu & Adamu (2021) observe that the cyclical nature of vandalism, where each act of destruction leads to further vulnerability, significantly hampers agricultural productivity in affected areas. Additionally, the psychological toll on farmers, who live in constant fear of losing their crops or equipment, cannot be underestimated. This creates a vicious cycle of underinvestment in agriculture, further exacerbating food insecurity.

Banditry

The coefficient for banditry is -4.00, indicating a highly significant negative effect on food production, with a p-value of 0.000 confirming the statistical significance of this relationship. Banditry, which involves the theft of crops, livestock, and farming equipment, as well as the destruction of farmland, severely disrupts agricultural activities and reduces food availability. In regions affected by banditry, farmers often face constant threats to their livelihoods, making it difficult for them to plan for the future or invest in their farms. The loss of essential resources, such as livestock and farming tools, directly impacts the productive capacity of farmers, leading to decreased agricultural output. Moreover, banditry creates an environment of fear and instability, which not only affects farmers but also disrupts entire communities, leading to a breakdown in local economies and food systems.

The -4.00 coefficient for banditry suggests that the impact of this insecurity type is both immediate and long-lasting. Farmers, facing the continuous threat of theft and violence, may choose to abandon their farms or limit their production efforts to avoid further losses. The fear of attack and the destruction of agricultural assets can lead to underutilization of available farmland, as farmers are unable to work their land with the same level of confidence as in more secure environments. Odalonu & Egbogu (2023) argue that the pervasive nature of banditry in rural areas not only disrupts farming activities but also hinders the ability of farmers to access essential services, such as markets, inputs, and credit, further compounding food insecurity. This highlights the urgent need for improved security measures in rural areas to ensure that farmers can safely cultivate their land and restore agricultural productivity.

Farmer/Herder Conflict

The coefficient for farmer/herder conflict is -3.80, indicating a significant negative impact on food production, with a p-value of 0.002 confirming the statistical significance of this relationship. Conflicts between farmers and herders often arise over competition for scarce resources such as land and water, which are essential for both crop farming and livestock grazing. These conflicts can escalate into violent confrontations, leading to the destruction of crops, the loss of livestock, and the displacement of farming communities. The -3.80 coefficient suggests that the negative effects of farmer/herder conflicts are particularly severe, as they disrupt entire agricultural systems, resulting in long-term reductions in food production. This type of conflict undermines farmers' ability to plan and invest in their farms, as they fear for the safety of their crops and livestock.

The displacement of farmers due to farmer/herder conflicts further exacerbates food insecurity, as displaced individuals are unable to return to their land or continue farming. Okpa *et al*., (2023) emphasize that these conflicts not only result in the immediate destruction of farmland but also create a cycle of instability, where farmers are unable to access the resources necessary for agricultural production. As entire communities are forced to relocate, agricultural value chains are disrupted, leading to food shortages in affected regions. Furthermore, the insecurity created by farmer/herder conflicts can limit access to credit, inputs, and extension services, which are vital for improving agricultural productivity. The -3.80 coefficient underscores the urgency of addressing these conflicts through conflict resolution mechanisms, improved resource management, and policy interventions that promote cooperation between farmers and herders. By fostering peaceful coexistence and ensuring equitable access to resources, food production can be enhanced, thereby improving food security in conflict-prone areas.

Boko Haram Insurgency

The coefficient for Boko Haram insurgency is -2.50, indicating a significant reduction in food production in North Central Nigeria, with a p-value of 0.024 confirming the statistical significance of this relationship. The Boko Haram insurgency has wreaked havoc on agricultural regions, leading to the destruction of crops, the theft of livestock, and the displacement of farmers. The insurgents' violent activities, including attacks on rural communities and agricultural infrastructure, have disrupted farming operations, making it difficult for farmers to access their land and resources. This has resulted in significant reductions in agricultural productivity and an increase in food scarcity, particularly in areas where farming is the primary livelihood. The -2.50 coefficient highlights the severity of the insurgency's impact on food production, emphasizing that the effects of the insurgency are both direct and long-term.

The long-term consequences of the Boko Haram insurgency on food insecurity are devastating. As farms are destroyed, and farmlands are abandoned due to the threat of violence, the agricultural system collapses, leading to an increased dependence on food imports to meet local demand. Oladosu *et al*., (2025) argue that the insurgency has led to widespread displacement, leaving farmers without the means to produce food and creating a severe shortage in the supply of staple crops. This situation is exacerbated by the destruction of essential agricultural infrastructure, such as roads, irrigation systems, and storage facilities, which further limits farmers' ability to produce and store food. As the insurgency continues, farmers are deterred from investing in farming inputs such as seeds, fertilizers, and machinery, which reduces yields and impedes agricultural recovery.

Economic Insecurity

The coefficient for economic insecurity is -2.00, indicating a significant negative relationship between economic instability and food production, with a p-value of 0.000 confirming its statistical significance. Economic insecurity, characterized by high inflation, currency devaluation, and limited access to financial resources, severely restricts farmers' ability to invest in agricultural inputs such as seeds, fertilizers, and machinery. This limitation directly reduces productivity and leads to a decline in food production. In many regions, economic insecurity is also linked to broader socio-political instability, where the lack of access to credit and markets further hampers farmers' ability to plan and invest in their farms. The -2.00 coefficient suggests that economic insecurity is a significant barrier to food production, highlighting the need for policies that address economic instability and provide financial support to farmers.

The negative impact of economic insecurity is particularly pronounced in areas where the cost of production is rising due to inflation, and farmers struggle to access affordable credit or financial assistance. Okpala *et al*., (2023) argue that the inability of farmers to secure loans or access markets for their produce exacerbates food insecurity, as farmers cannot afford the necessary inputs or expand their agricultural operations. Economic insecurity also affects the ability of farmers to respond to market fluctuations, as they are unable to invest in technology or diversify their farming practices.

Financial Insecurity

The coefficient for financial insecurity is -1.10, suggesting that financial instability negatively impacts food production, although the p-value of 0.069 indicates that this relationship is on the borderline of statistical significance. Financial insecurity can prevent farmers from accessing the capital necessary to invest in agricultural technologies, such as modern irrigation systems, machinery, and improved seeds. This results in lower productivity and reduced food output, as farmers are unable to enhance their farming practices or expand their operations. While the negative relationship between financial insecurity and food production is weaker than other forms of insecurity, it still highlights the importance of financial stability in supporting agricultural productivity. Farmers in regions with limited access to financial resources are often unable to respond to market demands or adopt new farming methods, which reduces their ability to increase food production.

The marginal significance of financial insecurity suggests that while it may not have as immediate an impact on food production as other insecurity factors, it still plays a crucial role in shaping agricultural outcomes. In areas where farmers face financial barriers, they may resort to traditional farming methods that are less efficient or productive. Okunlola & Ayetigbo (2024) highlight that financial insecurity in rural areas is often compounded by limited access to

formal banking services, which makes it difficult for farmers to secure loans or invest in productivity-enhancing technologies. Despite its weaker impact, addressing financial insecurity is critical for improving agricultural productivity. Ensuring that farmers have access to credit, subsidies, and financial services will enable them to invest in their farms, improve yields, and reduce food insecurity in the long term.

Income Level

The coefficient for income level is 1.20, indicating a strong positive relationship between higher income levels and increased food production, with a p-value of 0.000 confirming that this relationship is statistically significant. Higher income levels provide farmers with the financial means to invest in agricultural inputs, such as high-quality seeds, fertilizers, and equipment, thereby enhancing productivity. Income also allows farmers to adopt modern farming techniques and technologies that improve efficiency, increase yields, and reduce losses. The positive coefficient of 1.20 suggests that income plays a critical role in enabling farmers to overcome financial barriers and invest in practices that boost agricultural output. As farming becomes increasingly capital-intensive, the ability to invest in necessary resources is essential for maintaining productivity and ensuring food security.

The relationship between income level and food production underscores the importance of economic empowerment for farmers. Higher income allows farmers to not only invest in inputs but also to withstand the effects of external shocks such as market price fluctuations, climate change, or insecurity. Kehinde *et al.,* (2021) found that increased income enables farmers to improve their farm management practices, access better resources, and enhance the sustainability of their operations.

Access to Technology

The positive coefficient of 2.50 for access to technology indicates that access to modern farming technologies significantly enhances food production, with a p-value of 0.001 confirming the statistical significance of this effect. Technologies such as irrigation systems, mobile farming apps, and precision farming tools allow farmers to optimize their agricultural practices, reduce waste, and increase yields. Access to technology is particularly important in regions where traditional farming methods are still prevalent, as it can help bridge the gap between low-tech and high-tech farming systems. The coefficient of 2.50 suggests that technology is a powerful driver of agricultural productivity, enabling farmers to increase the efficiency of their work and produce more food with fewer resources.

The transformative potential of technology in agriculture extends beyond simple efficiency gains. With access to modern tools, farmers can monitor weather patterns, manage irrigation systems more effectively, and track pest infestations, all of which contribute to better-informed decision-making. Additionally, mobile farming apps and online platforms can connect farmers to markets, provide them with agricultural knowledge, and help them access financial services.

Access to Extension Services

The coefficient for access to extension services is 1.80, indicating a statistically significant positive impact on food production, with a p-value of 0.034 confirming the robustness of this relationship. Extension services play a crucial role in bridging the knowledge gap between farmers and modern agricultural practices. These services provide farmers with essential training in best practices for soil management, pest control, crop rotation, and resource optimization. Through regular interactions with extension agents, farmers gain access to updated information on new agricultural technologies, market trends, and climate adaptation strategies. This improved knowledge and skill set translate directly into enhanced farming practices, leading to increased agricultural productivity.

The 1.80 coefficient suggests that farmers who regularly engage with extension services are more likely to experience higher food production levels. These services not only help farmers improve yields but also reduce postharvest losses by educating them on efficient storage techniques and processing methods. Moreover, extension services often act as a link between farmers and government programs, providing them with access to subsidies, financial aid, and technical support. The positive effects of extension services are particularly significant in regions where smallholder farming dominates, as these farmers often lack the resources or knowledge to adopt more efficient practices on their own. Enhancing access to extension services should be a priority in agricultural policies, as these services have the potential to dramatically improve food production and contribute to overall food security.

Market Accessibility

The coefficient for market accessibility is 1.40, reflecting a positive relationship between improved access to markets and higher food production, with a p-value of 0.005 confirming the statistical significance of this effect. When farmers have easy access to local, regional, and national markets, they are better able to sell their produce at fair prices, which in turn enables them to reinvest their earnings into their farms. Access to markets also helps reduce food waste, as farmers can sell their produce before it spoils, especially in areas with limited cold storage facilities. By reaching more buyers, farmers are able to diversify their sales channels, increasing their income and ensuring that surplus produce does not go to waste.

The 1.40 coefficient highlights that improved market access not only enhances financial returns but

also strengthens food systems by creating stable supply chains. Market access helps farmers to adjust production based on demand, promoting a more efficient allocation of resources. Furthermore, it enables farmers to obtain critical inputs, such as fertilizers, seeds, and pesticides, which are necessary for improving productivity. In addition to improving the economic stability of individual farmers, better market access fosters greater food security in the broader community by ensuring a steady and reliable flow of food to local and regional markets.

Security Forces and Protection

The coefficient for security forces and protection is 2.20, indicating a significant positive impact on food production, with a p-value of 0.010 confirming the statistical significance of this relationship. The presence of security forces in agricultural areas plays a pivotal role in ensuring the safety and stability needed for productive farming activities. In regions prone to insecurity, such as those affected by banditry, farmer/herder conflicts, or insurgency, the visible presence of security forces reduces criminal activities that target farmers, including theft, arson, and vandalism. This creates a safer environment in which farmers can engage in agricultural work without the constant fear of attack or loss of their resources.

The 2.20 coefficient emphasizes that security forces not only protect farmers' assets but also foster a sense of confidence and stability within the farming community. Farmers in areas with adequate security protection are more likely to invest in their farms, adopt new technologies, and increase production levels. Moreover, security forces enable the delivery of agricultural support services, such as extension programs and infrastructure development, without disruption from criminal activities. The positive effect of security forces extends beyond protecting physical assets; it also enhances the overall functioning of the agricultural sector by allowing farmers to operate in an environment where they feel safe and secure. This underscores the importance of integrated security strategies that combine military presence with community engagement and conflict resolution.

Land Tenure Security

The coefficient for land tenure security is 1.90, with a p-value of 0.035 indicating a statistically significant positive influence on food production. Land tenure security refers to the legal and customary rights that farmers have to their land, ensuring that they can use, cultivate, and invest in their land without the fear of expropriation or forced displacement. Secure land tenure is a critical determinant of agricultural productivity because it incentivizes long-term investments in land management, conservation practices, and agricultural improvements. Farmers who have confidence in their land tenure are more likely to invest in soil conservation, irrigation systems, and other productivity-enhancing technologies. They are also more likely to take better care of their land, as they can reap the long-term benefits of their investments.

The 1.90 coefficient suggests that land tenure security contributes significantly to food production by providing farmers with the stability and confidence needed to engage in productive farming activities. When farmers have secure land rights, they are more likely to make decisions that enhance productivity, such as adopting modern farming techniques, diversifying crops, and increasing the use of inputs like fertilizers and machinery. Furthermore, secure land tenure improves access to credit, as financial institutions are more willing to lend to farmers who can use their land as collateral. This access to credit allows farmers to purchase essential inputs, such as seeds, equipment, and fertilizers, which in turn boosts food production. Land tenure security also reduces the potential for land disputes, which can disrupt farming activities and lead to displacement.

Table 7: Effect of types of insecurity on quantity of food produced during insecurity

Variable	Coefficient (β)	Standard Error	t-Statistic	p-value	VIF
Intercept (β0)	5.20	1.30	4.00	0.000	
Climate Change	-0.45	0.18	-2.50	0.013	1.70
Postharvest Insecurity	-2.00	0.95	-2.11	0.036	2.10
Household Size	0.50	0.20	2.50	0.013	1.95
Vandalism	-1.80	0.90	-2.00	0.047	2.40
Banditry	-4.00	1.10	-3.64	0.000	2.50
Farmer/Herder Conflict	-3.80	1.20	-3.17	0.002	2.60
Boko haram insurgency	-2.50	1.10	-2.27	0.024	2.00
Economic Insecurity	-2.00	0.55	-3.64	0.000	2.30
Financial Insecurity	-1.10	0.60	-1.83	0.069	1.80
Income Level	1.20	0.30	4.00	0.000	1.90
Access to Technology	2.50	0.75	3.33	0.001	2.20
Access to Extension Services	1.80	0.85	2.12	0.034	2.00
Market Accessibility	1.40	0.50	2.80	0.005	1.85
Security Forces and Protection	2.20	0.85	2.59	0.010	1.90
Land Tenure Security	1.90	0.90	2.11	0.035	1.95

Variable	Coefficient (β)	Standard Error	t-Statistic	p-value	VIF
R-Square	0.70				
F-ratio	46.73			0.000	

Source: Field survey, 2024

Research Hypothesis

One Sample Test for Crop Production before and During Insecurity

The results from the paired samples test indicate a significant mean difference of 2,296.924 between crop output before and during periods of insecurity, with a standard deviation of 2,000. The t-value of 21.791, accompanied by a p-value of 0.000, provides strong statistical evidence that the observed reduction in crop output is highly unlikely to have occurred by chance. This substantial mean difference highlights that farmers experience considerable losses in crop production when insecurity disrupts their activities, which is a critical concern for food security in rural areas. Factors such as violence, theft of produce, forced displacement, and interruptions in vital farming operations like land preparation, planting, and harvesting, all contribute to this decline in productivity. As a result, household income diminishes, and food availability in rural communities is severely threatened.

This finding aligns with existing research, which underscores the detrimental impact of insecurity on agricultural productivity. Egbule and Okonta (2024) and Olanrewaju and Balana (2023) observe that armed conflict and rural insecurity often lead to the destruction of farmland, theft of crops, and displacement of farming households challenges that directly mirror those encountered in this study. Furthermore, insecurity frequently damages critical infrastructure such as roads, irrigation systems, and storage facilities, complicating the transportation of produce to markets and leading to increased postharvest losses. The statistically significant p-value of 0.000 confirms that the reduction in crop yields is not due to random variation but is instead a direct consequence of an unsafe farming environment. These results underscore the urgent need for targeted security interventions to protect agricultural production, stabilize rural livelihoods, and address the food security challenges that arise from prolonged periods of insecurity. Future policies should prioritize measures to secure both physical and social infrastructure, ensuring that farming activities can proceed without fear of disruption.

Table 8: One sample test for crop production before and during insecurity

Paired Samples Test	T	Df	Sig. (2-tailed)	Mean Difference	Std. Deviation	Std. Error Mean
Output before Insecurity - Output during Insecurity	21.791	359	0.000	2296.924	2000	105.409

Source: Field survey, 2024

Coping Strategies to Mitigate Insecurity

Seeking Financial Assistance from Family and Friends

The most commonly adopted coping strategy among arable crop farmers was seeking financial assistance from family and friends (76.4%), emphasizing the significant role of informal social safety nets in rural communities. This aligns with the findings of Estrin *et al*., (2025), who noted that rural farmers often rely on kinship networks for support during crises when formal institutions fail. Additionally, 68.1% of respondents indicated they used personal savings, while 61.9% sought loans from banks or microfinance institutions. These figures highlight the essential need for accessible and reliable financial support systems that can help buffer farmers against the shocks caused by insecurity. However, while informal networks like family and friends provide immediate relief, their sustainability is limited, particularly during prolonged crises when many households are affected simultaneously. Over-reliance on these informal networks can lead to debt cycles, further exacerbating vulnerabilities (FAO, 2022). In periods of continued insecurity, the capacity of family and friends to provide financial aid diminishes, and as a result, farmers face additional economic pressures. While effective in the short-term, this strategy cannot serve as a long-term solution for coping with persistent insecurity. Policymakers should consider integrating these informal support systems into formal welfare mechanisms to ensure more robust, sustainable support for rural populations.

Reporting Incidents to Authorities

Seventy-three percent of farmers reported incidents to local authorities as a common coping strategy in the face of insecurity. This reflects a significant effort to engage with formal security systems to address theft, vandalism, and violence. Reporting to authorities offers a mechanism for justice and the potential recovery of stolen goods or preventive measures, highlighting farmers' attempts to mitigate insecurity through formal channels. However, the real effectiveness of this strategy depends on the response time and accountability of the security agencies involved, which is often inconsistent and unreliable. Despite the intention to improve safety through formal channels, many farmers face frustration due to the lack of follow-up and fear of reprisals. The failure of security

agencies to act on reports not only discourages further engagement with the system but also undermines trust between farmers and authorities. This erosion of trust weakens the social contract and exacerbates insecurity. To improve the effectiveness of this strategy, strengthening relationships between farmers and security agencies is essential. Initiatives like community policing, which empower local populations to be actively involved in security efforts, can be key in ensuring a more reliable and coordinated response. Enhancing the transparency and responsiveness of law enforcement is crucial to restoring confidence and ensuring that farmers' concerns are addressed in a timely and effective manner.

Changing Transport Routes

Changing transport routes was adopted by 70% of farmers as a strategy to safeguard their goods and personnel from the threat of ambushes, checkpoints, and theft. This tactic highlights the significant logistical challenges faced by farmers, particularly in regions where criminal gangs and road ambushes are prevalent. As Norton (2022) observed, farmers are often forced to take longer or less direct routes, which increases transportation costs and delays product delivery. This is especially problematic for perishable goods, which lose their market value and quality over time, reducing farmers' profits. While this strategy offers some immediate protection, it comes at a cost—both financial and operational. The added transportation expenses further strain farmers' limited resources, reducing their competitiveness and profitability. Moreover, frequent rerouting reflects the lack of a secure and well-coordinated rural transportation network, underscoring the need for improved infrastructure to support the safety and efficiency of agricultural supply chains. Without such infrastructure, farmers will continue to face logistical challenges that hinder both short-term survival and long-term growth in the agricultural sector. Efforts to improve rural security and road safety must be prioritized to mitigate these disruptions and reduce the financial burden on farmers.

Joining Local Security Groups or Cooperatives

A significant 69.4% of farmers reported joining local security groups or cooperatives to protect their farms from theft and other security threats. These community-based initiatives are formed by farmers to protect their assets and create a sense of collective security in areas where formal security is lacking. They leverage local knowledge of the terrain and community relationships to respond quickly to threats, making them an important resource in rural security. However, the effectiveness of these groups is often limited by a lack of formal training, resources, and support. Many of these local groups are not equipped to handle organized criminal activities, and tensions can arise between them and official security forces, leading to operational conflicts. Despite these challenges, the existence of such groups demonstrates the strong resilience of rural communities. With proper training, regulation, and integration into formal security systems, these groups could play a vital role in improving rural security. Policy initiatives that strengthen local security networks, provide training, and establish better coordination with official law enforcement agencies could enhance their effectiveness and provide a more comprehensive security framework for farmers.

Cutting Down on Non-Essential Expenses

The strategy of cutting down on non-essential expenses was reported by 69.2% of farmers, reflecting the financial strain imposed by insecurity. In times of reduced income and disrupted production, farmers prioritize essential expenses such as food, healthcare, and education, often postponing or eliminating spending in other areas. This prioritization helps farmers manage immediate financial needs without accumulating further debt, but it also carries long-term risks. Constantly reducing non-essential spending may diminish a household's ability to invest in long-term well-being, such as education, preventive healthcare, or agricultural improvements like irrigation systems. Over time, this strategy could limit a household's ability to grow or recover after periods of insecurity. For example, cutting back on educational expenses can limit children's future prospects, while neglecting farm investments can reduce productivity in the long run. The challenge lies in balancing short-term survival with long-term sustainability. Policymakers should consider creating support systems that allow farmers to manage these short-term crises without undermining their long-term growth prospects. Such systems could include targeted subsidies or financial planning assistance that help farmers prioritize essential expenditures while still investing in the future.

Using Personal Savings

Personal savings were used by 68.1% of farmers to cope with the financial pressures of insecurity. Savings serve as an essential buffer that enables households to cover necessary expenses and make urgent repairs when income is interrupted. In rural areas where access to formal credit is limited, personal savings can be the only means of addressing immediate needs. However, relying on personal savings comes with significant risks. If savings are depleted and not replenished, farmers may be forced to turn to high-interest loans or liquidate productive assets to cover their expenses, further undermining their financial stability. To mitigate these risks, it is important to encourage collective savings schemes and create opportunities for income diversification. These measures can help reduce individual financial burdens and create more sustainable financial safety nets. Furthermore, expanding access to formal financial services, including low-interest loans and insurance, would allow farmers to better manage risks and avoid depleting their personal savings. A more comprehensive financial support system could help stabilize household income and improve farmers' resilience to ongoing insecurity.

Table 9: Coping strategies adopted by farmers to mitigate insecurity

Coping Strategy	Frequency	Percentage (%)
Seeking financial assistance from family/friends	275	76.4
Changing transport routes	252	70.0
Joining local security groups or cooperatives	250	69.4
Cutting down on non-essential expenses	249	69.2
Reducing or halting production temporarily	242	67.2
Forming alliances with neighboring farmers	240	66.7
Using personal savings	245	68.1

Source: Field survey, 2024

CONCLUSION AND RECOMMENDATIONS

This study highlights the escalating impact of insecurity on food scarcity among arable crop farmers in the North Central Zone of Nigeria. A clear and substantiated correlation exists between the rising levels of insecurity and the decline in food availability, as evidenced by significant reductions in both farmers' income levels and agricultural productivity. The predominant forms of insecurity ranging from crop theft and land destruction by armed groups to violent farmer-herder conflicts have severely disrupted farmers' ability to maintain stable food production, thus exacerbating existing food shortages in the region. This economic decline, compounded by persistent insecurity, has pushed many households into lower income brackets, thereby diminishing their purchasing power and perpetuating the cycle of food scarcity. Despite the severity of these challenges, farmers have demonstrated remarkable resilience by adopting various coping strategies, such as seeking financial assistance from informal networks and organizing local security groups. While these adaptive strategies offer temporary relief, they are insufficient to address the structural and systemic causes of insecurity and its far-reaching effects on agricultural productivity. The findings from this study underscore the urgent need for a coordinated and comprehensive response to mitigate the impacts of insecurity on agricultural livelihoods and food availability. If left unaddressed, the consequences for food scarcity not only in the North Central Zone but across Nigeria could be catastrophic. Continued disruptions to agricultural production are likely to result in more severe food shortages, prolonged economic decline, and the displacement of vulnerable populations, further exacerbating the cycle of poverty and insecurity. The window for effective intervention is closing rapidly, making it crucial for both governmental and non-governmental actors to take immediate and decisive action. Strategic interventions are required to restore stability, bolster food production, and enhance the resilience of farming communities, thereby preventing the long-term effects of this crisis from becoming irreversible. The findings suggest that:

i. Enhance collabouration between government agencies, local authorities, and security forces to create secure farming environments. Integrate technology and community-based security networks to safeguard farmers' livelihoods.
ii. Introduce government subsidies, low-interest loans, and emergency grants to stabilize farm incomes during insecurity. Explore insurance schemes that cover losses due to insecurity for additional financial protection.
iii. Provide training programs on sustainable agricultural practices, crop diversification, and modern techniques to help farmers adapt to changing conditions. Strengthen resilience by reducing dependency on traditional farming methods.
iv. Invest in roads, storage facilities, and market access to improve resilience against insecurity. Ensure reliable infrastructure for the smooth transportation of produce, maintaining food supply even in vulnerable areas.
v. Implement climate-smart practices like drought-resistant crops and better postharvest management. Equip farmers to manage both environmental challenges and security-related disruptions to enhance food security.
vi. Foster long-term peace-building efforts to address farmer-herder conflicts. Promote dialogue, mediation, and collabouration to reduce tensions and safeguard food production activities.

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