



Climate variability Awareness, a Sine-qua non to Adaptation Strategies of Smallholder Farmers: Evidence from Tomato Farming in Northern Nigeria

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ABSTRACT

The study examines tomato farmer's awareness of climate variability and factor that influence their adaptation strategies in Igabi Local Government Area of Kaduna State, Northern Nigeria. Using questionnaire, data was collected from 382 farmers. Descriptive and inferential statistics was used to analyze the data. Results show (90%) level of awareness of climate variability among farmers. Also, the results revealed that climate variability has propelled farmers to employ the use of various adaptation strategies such as the use of high yielding seeds, application of fertilizer, use of modern farming equipment, irrigation, changing farming practice and extension services. The study recommends fertilizer subsidies, seedlings subsidies, rigorous extension services and climate variability awareness to the farmers.

ARTICLE INFO

Article History

Received: November, 2022

Received in revised form: February, 2023

Accepted: March, 2023

Published online: March, 2023

KEYWORDS

Climate Variability, Awareness, Sine-qua non, Adaptation, Tomato Farmers.

INTRODUCTION

The magnitude at which climate variability affect the output of most crops including the vegetables cannot be underestimated (Guodaar et al. 2017). Poverty is exacerbated by climate variability due to its direct negative effect on agriculture, environment and livelihoods. Events such as high temperatures, recurrent droughts and erratic rainfall patterns often lead to a significant loss in agricultural production, which manifests itself through crop failure, while the adaptive capacity of the farmers to withstand the shocks remain low. The negative impacts of climate variability on agriculture places additional pressure on smallholder farmers due to their direct

dependence on agriculture, and their inability to respond adequately to climate shocks as well as constrained resources, thus, making them more vulnerable (Olabanji et al, 2021; Tucker et al, 2010).

Globally, agricultural production has decline by 1-5% due to change in climate, while 50% of agricultural yields was projected to be lost in Africa by the year 2020 (IPCC, 2014). The negative impacts of climate variability would be more devastating on smallholder farmers due to their direct dependence on agriculture, their inability to respond adequately to climate shocks as well as constrained resources, thus, countries in the tropical regions with already high numbers of

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poor smallholder farmers would be hardest hit by the impact of climate change (Hertel and Rosch 2010; Harvey et al. 2014). Furthermore, World Bank has shown that countries of sub-Saharan Africa are the most widely affected by this phenomenon due to the weakness of their production systems based essentially on subsistence agriculture (Baarsch et al. 2020). According to Mouleye et al. (2019), agricultural production in Sub-Saharan Africa is dependent on climatic vagaries, low yields and the absence of adequate adaptation strategies. Tomato farming in Nigeria is not insulated from this crisis, being among the agricultural activities undertaken by smallholder farmers, and contribute immensely to the socio-economic development of the country. However, about 80% of tomato seeds planted by farmers are generic varieties which spoils faster due rainfall and temperature patterns, particularly during the dry season, which runs from December through April (TechnoServe, 2022). Adelani and Akeredolu, (2020) alluded that climate variability is the most important factor that is responsible for the reduction in Tomato and citrus change production in Agricultural Development Programme (ADP) zones of Nigeria. Reduction in crop yields due to climate variation has also been established in many African countries such as Gauteng, Limpopo and Mpumalanga provinces of South Africa that reported significant losses in crop yields induced by climate variability (Elum et al., 2017). In Zimbabwe, smallholder farmers in Chirumanzu district revealed that climate variability has reduced their crop yields (Manyani et al., 2017).

Vegetables, such as tomato, pepper and onions, are the most important vegetable in Northern Nigeria and are largely produced by smallholder farmers. A decline in the rate of crop and vegetables production is being experienced in the country, and it is expected to continue into the future as a result of the anticipated increase in temperature and decrease in rainfall (Adelani and Akeredolu, 2020). In response to the declining trends of vegetable and crop production to climate variability, adaptation is increasingly seen as a panacea towards improving crop production, sustaining food security and livelihoods. Farmers have to adapt their farming systems to the changing climate. Adapting to climate change entails taking the right measures to reduce the negative effects of climate change by making the appropriate adjustments and changes. Masud et al. (2017) alluded that there is the need to convince farmers that climate is changing in order to take appropriate adaptation strategies. According to Mavhura et al. (2021), reduction of farmers vulnerability and enhancement of their resilience to climate stressors is determine by their adaptation capacity.

Research has shown that significant number of farmers in Bangladesh with informed climate variability knowledge had high potential to support policies and programmes aimed at addressing climate change (Alam et al., 2017). While misconception about climate variability can lead to complacency and or, inappropriate changes in farming systems (Mavhura et al. 2021). This means that farmer's awareness on climate variability is important factor in determining their

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adaptation strategies. For example, Fachrista et al. (2019) reported the link between vegetable farmers awareness of climate variability and adaptation strategies in Central Java, Indonesia where farmers that acquired climate change information collaborates with local research institutions in the implementation of a range of adaptation strategies. In Ghana, Guodaar et al. (2017) show that climate information is one of the major determinants that influence farmers' agricultural production.

Based on the foregoing, the present study expounds tomato farmer's awareness of climate variability and adaptation strategies in Igabi Local Government. On hand, Igabi LGA is the largest LGA in Nigeria in terms of land mass, and area of intensive agricultural farming, on the other hand, research on climate change in Nigeria has shown that the degree of farmers vulnerability to climate change vary from one region of the country to another. The northeast and northwest geopolitical zones where Igabi LGA is located, and that constitute the arid and semi-arid areas of northern Nigeria are the most vulnerable to climate change in the country. The regions have low adaptive capacity, low sensitivity, high relative exposure and high relative vulnerability (NCCP, 2021). Therefore, the need to establish a nexus between climate variability and food production in the region cannot be overemphasize requires. To this end, we intend to address the following questions; 1. What is the level of tomato farmer's awareness of climate variability? 2. To what extent does

climate variability affect tomato production? 3. What are the adaptation strategies employed by the tomato farmers in the area?

METHODOLOGY

Igabi Local Government area is situated in Kaduna state and in Northern Nigeria. This is shown in (Figure 1). It lies between latitudes $10^{\circ}47'0''N$ and longitudes $7^{\circ}46'0''E$. It is bounded by Zaria LGA in the North, Kajuru, Kaduna north, Kaduna south and Chikun LGA in the South, Kaduna south LGA in the South-West, Soba and Kauru in the East and Birnin gwari and Chikun LGA in the West.

Agriculture is the major occupation of the people of Igabi LGA with crops and vegetables such as yams, sugarcane, guinea corn, beans, maize, tomato, onion and pepper that are grown in substantially large quantities. Also, animals such as cows, horses, and rams are reared in the area. Trade also blossoms in Igabi LGA with the area hosting several markets such as the Rigasa district and the Gadangaya markets. Other important economic activities in Igabi LGA include hunting and blacksmithing (Manpower Nigeria, 2022).

Snowball sampling technique was used in the selection of respondents. Using the Krejcie and Morgan (1970) method of determination of sample size, a sample size of 382 was arrived at. Using National Population Commission 2006, the population of Igabi L.G.A was about 430,753 people and the growth rate of 1.80% giving 564,286 as at 2021.

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RESULTS AND DISCUSSION

Socioeconomic and demography of the respondents in relation to climate variability and adaptation strategies

Table 3.1: Educational Background and climate variability adaptation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	FSLC	22	5.8	5.8	5.8
	WAEC/GCE?NECO	209	54.9	55.1	60.9
	OND/HND/B.Sc.	123	32.3	32.5	93.4
	M.Sc./PGD/MBA/PHD	9	2.4	2.4	95.8
	Others	16	4.2	4.2	100.0
	Total	379	99.5	100.0	
Missing System		3	.7		
Total		382	100.0		

Source: Field Survey, 2022

The level of education status is seen as a significant factor that influence farmer's adaptation to climate variability. This implies that the probability of adapting to climate change is greater for farmers with better education compared to less-educated. The result in Table 3.1 shows that 5.8% of the respondents are Primary school certificate holders, while 54.9% are secondary school certificate holders. Also, 32.3% are OND/HND/BSC

holders, and 2.4% are Postgraduate certificate holders, while 4.2% have other qualifications. The result is indicate that farmers that spent 11 years at school are expected to be literate and able to interpret farming information, as well as capable of using cutting-edge new technology to adapt to climate variability. This result is in line with what was obtained among tomato farmers in Offinso North District of Ghana by Guodaar and Eshun (2017).

Table 3.2: Marital Status and adaptation capacity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	single	136	35.7	35.7	35.7
	married	211	55.4	55.4	91.1
	divorced	35	9.2	9.2	100.0
	Total	382	100.0	100.0	

Source: Field Survey, 2022

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Marital status is an important factor that decides the rate at which people are involved in farming activities and adaptation to the prevailing weather condition, especially in their quest to provide food and other means of livelihoods to the families. Result in Table 3.2 shows that 35.7% of the

respondents are single, while 55.4% are married, and 9.2% are divorced. The result is indicative that more married people are involved in tomato farming, hence they will use many measure to adopt so that they take care of their families.

Table 3.3: Occupation of the respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Farming	176	46.2	46.2	46.2
	Civil service	111	29.1	29.1	75.3
	student	87	22.8	22.8	98.2
	unemployed	8	2.1	2.1	100.0
	Total	382	100.0	100.0	

Source: Field Survey, 2022

Table 3.3 show the category of people involved in tomato farming activities in the study area. The result indicated 46.2% of the respondent's occupation is farming. While, 29.1% are

civil servants, and 22.8% are students, while, 2.1% are unemployed. This result indicated that majority of the respondents are farmers.

Relationship between farmer's awareness of climate variability and tomato farming

Table 3.3: Aware of climatic variability and tomato farming ANOVA

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2.248	3	.749	9.199	.000
Within Groups	30.305	372	.081		
Total	32.553	375			

Source: Field Survey, 2022

Table 3.3 shows that there is significant difference since the level of significance is less than 0.05 and the F value is greater so we reject the null hypothesis. Therefore, the level of relationship between awareness of

climate variability and tomato farming is significant. This means the aware of the climate variability among the respondents and tomato farming is significant. s. These results are in line with the findings of Fadina and Barjolle

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(2017) who stated that farmers have noticed changes in climatic conditions due to increased temperatures and decreased rainfall. This implies that farmers in the study area noticed the climate variability and that these variation may adversely affect their agricultural productivity. However, Adelani and Akeredolu (2020) showed no significant relationship between knowledge level of respondents and change in production of tomato in

Southern Nigeria. They argued that the level of knowledge of climate variability has nothing to do with tomato production, but adaptation strategies is the key. Similarly, Guodaar and Eshun (2017) showed a significant negative relationship between temperature and tomato production as well as rainfall and tomato production but positive relationship between tomato production and vehicular emissions, deforestation, slash and burn as well as spiritual forces.

Adaptation strategies of the farmers

Table 3.5: Use of high yielding seed as a way of adapting to climate variability

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	68	17.8	17.8	17.8
	Yes	314	82.2	82.2	100.0
Total		382	100.0	100.0	

Source: Field Survey, 2022

The use of high yielding seeds is known to mitigate the impact of climate variability on agricultural production. Result in Table 3.5 shows that 82% who are majority of the respondents are using high yielding seed as a way of adapting to the impact of climate variability. Based on the result, the use of high yielding variety is a significant factor in

adaptation strategy among farmers in the study area. This corroborates the findings of Mdoda (2020) in Eastern Cape Province of South Africa where it was identified that crop diversification as the most promising strategies for enhancing agricultural productivity for farmers.

Table 3.6: Application of fertilizer as a way of adapting to climate variability

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	59	15.5	15.6	15.6
	yes	318	83.5	84.4	100.0
	Total	377	99.0	100.0	
Missing System		4	1.0		
Total		382	100.0		

Source: Field Survey, 2022

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Table 3.6 shows that application of fertilizer was found to have a positive influence on the adaptation to climate variability among the farmers. The results shows that 83.5% of the respondent applied more fertilizers to

adopt to climate variability. This result concur with the outcome of a study conducted in Olifant Catchment of South Africa by Olabanji et al (2021) which shows that 72% of the farmers applied fertilizer to adopt to climate change.

Table 3.7: Use of modern farming equipment as a way to adapt to climate variability

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	112	29.4	29.5	29.5
	Yes	269	70.4	70.5	100.0
	Total	380	99.7	100.0	
Missing System		1	.3		
Total		382	100.0		

Source: Field Survey, 2022

Result in Table 3.7 shows that 70% of the respondents have indicated that they have shifted to the use of

modern farming equipment as a way of adopting to the change in climate.

Table 3.8: Use irrigation facility to adapt to unreliable rainfall

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	46	12.1	12.1	12.1
	Yes	334	87.7	87.9	100.0
	Total	380	99.7	100.0	
Missing System		2	.5		
Total		382	100.0		

Source: Field Survey, 2022

Result in Table 3.8 shows that 87.7% of the respondents use irrigation facilities to adapt to unreliable rainfall occasioned by the climate variability in the study area. Also Olabanji et al (2021)

shows that rainwater harvest, irrigation and planting of trees are some of the adaptation measures in their area of study.

Table 3.9: changing farming practice to adapt to climate variability

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	32	8.4	8.5	8.5
	yes	346	90.8	91.5	100.0
	Total	378	99.2	100.0	
Missing System		4	1.0		
Total		382	100.0		

Source: Field Survey, 2022

Result in Table 3.9 shows that 90.8% of the respondents are into irrigation farming to adopt to climate variability. This implies that farmers are no longer depending on rain-fed agriculture in the study area in order to overcome the vagaries of climate change.

Table 3.10: Access to extension services and adaptation to climate variability

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High	265	69.6	71.6	71.6
	Low	105	27.6	28.4	100.0
	Total	370	97.1	100.0	
Missing System		12	3.1		
Total		382	100.0		

Source: Field Survey, 2022

Access to extension services is expected to improve the adoption measures and reduce the negative impacts of changing Variability (Azumah et al., 2021). Teshome et al., (2021) show that limited access to extension services is the main barriers to climate change adaptation. Therefore, Table 3.10 shows that there is high extension services in the study are 69.6%, and 27.4% indicated low extension services.

Improvement due to adaptation strategies

Table 3.11: Adaptation strategies and improvement in harvest

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	36	9.4	9.5	9.5
	yes	341	89.5	90.5	100.0
	yes	341	89.5	90.5	100.0

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	Frequency	Percent	Valid Percent	Cumulative Percent
Valid no	36	9.4	9.5	9.5
Total	377	99.0	100.0	
Missing System	5	1.3		
Total	382	100.0		

Source: Field Survey, 2022

Result in Table 3.11 shows that 89.5% of the respondents have recorded improvement in yields due to their adaptation strategies.

Table 3.12: Adaptation strategies and livelihoods improvement

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid no	47	12.3	12.5	12.5
yes	330	86.6	87.5	100.0
Total	377	99.0	100.0	
Missing System	5	1.3		
Total	382	100.0		

Source: Field Survey, 2022

Result in Table 3.12 revealed that 86.6% of the respondent have their livelihoods improved due to the adaptation strategies, while 12.3 % have indicated that their livelihoods haven't improved yet despite the adaptation strategies

CONCLUSION AND RECOMMENDATION

The study analyzed tomato farmers' awareness of climate variability and the factors that influence their adaptation strategies. The study found that majority of the tomato farmers are very much aware of climate variability. Due to this, farmers use inexpensive strategies to adopt such as use of high yielding seeds, application of fertilizer, use of modern farming equipment,

irrigation, changing farming practice and extension services. The study also looked at Socioeconomic and demography of the respondents in relation to awareness of climate variability and adaptation strategies which include educational background and marital status of the farmers. Based on the results, we recommend fertilizer subsidies, seedlings subsidies and rigorous extension services to the farmers.

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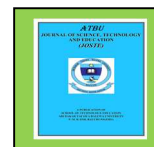
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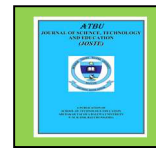
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