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Farmers' Climate Change Adaptation Strategies and Cassava Production in Akoko South West Local Government Area, Ondo State

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Abstract
This study focused on the effect of farmers' climate change adaptation strategies on cassava production in Akoko South West Local Government Area, Ondo State. A two-stage sampling procedure was used to select 120 respondents for the study. Data were collected through a well-structured and validated questionnaire and analysed using percentages and mean statistics. Findings from the study revealed that the major climate change events noticed in the study area were high temperature (96.7%), high humidity (86.7%) and reduction in rainfall days (83.3%). Similarly, reduced use of inorganic fertilizers and pesticides ($\bar{x}$=2.50) and planting different cassava varieties ($\bar{x}$=2.23) were the major adaptation strategies used by the cassava farmers. Farming experience (97.5%) and wealth (96.7%) were the major factors that determined farmers' choice of adaptation strategies. Consequently, the respondents strongly agreed that their adaptation strategies have led to the timely harvest of their cassava, ($\bar{x}$=4.53). Furthermore, a significant relationship existed between the adaptation strategies employed by the farmers and cassava production (r= 0.46, p<0.01). The study concluded that the adaptation strategies adopted by the farmers impacted cassava production. It was recommended that the climate adaptation strategies identified should be harnessed by relevant stakeholders to mitigate the effect of climate change on cassava production.

Keywords*: Climate change, adaptation, strategies, cassava production*

Introduction
Cassava is commonly grown in most states of Nigeria with Over 90% of rural families consuming the crop in one form or the other (Osuji, et. Al., 2023). Some of the states that produce cassava in large quantities in Nigeria include Anambra, Imo, Oyo, Ogun, Osun, Ondo, Delta, Edo, Kogi and Abia (USAID, 2019). Cassava production is highly sensitive to climatic changes from length and intensity of sunshine to rainfall and water application, soil condition and temperature due to evapotranspiration effects. It has been reported widely that climate also plays a major role in altering the development of cassava pests and pathogens shifting their interactions (FAO, 2019)**.** According to Nnadi et al. (2021), climate change is increasingly affecting the lives of many poor people in Sub-Saharan African countries. Since agriculture in Nigeria is mostly rain-fed, it follows that any climate change is bound to impact its productivity in particular and other socio-economic activities in the country. The impact could however be measured in terms of changes in rainfall patterns, reduction in availability of soil water, soil erosion, temperature increase, and windstorms (Kemi and Olusegun, 2020).

As further explained by the United Nations Framework Convention on Climate Change (UNFCCC) (2023) the effect of climate change implies that the local climate variability which people have previously experienced and adapted to is changing and this change is observed in a relatively great speed. Climate change is one of the most severe problems that the world is facing today. It has been suggested that it is a more serious threat than global terrorism. It is one of the most serious environmental threats facing mankind worldwide and affects agriculture in several ways, including its direct effect on food production. Adaptation involves managing the risks posed by climate change. Adaptation strategies are measures adopted by farmers to guard against loss due to increasing temperature and decreasing precipitation. Adaptation measures help farmers guard against loss due to increasing temperature and decreasing precipitation. OECD (2021) reported that climate change adaptation is fundamental to building resilient socio-economic and ecological systems. Adaptation. The main climate change adaptation strategies adopted by farmers include praying for rain, use of improved varieties, climate prediction, changes in cropping patterns and agro-forestry, controlling soil erosion and fertilizer application.

Even though over 90% of Nigeria's rural families routinely consume cassava, its production in Nigeria has been hampered by climate change-related events (Lenis et al., 2020). Presently, in Nigeria, it has been claimed that climate change has disrupted cassava yields, outputs and quality, causing food shortages and reduced supply (Kemi and Olusegun, 2020). The climate change that threatens cassava production includes rising temperatures, changes in rainfall patterns, or the increase of drought. This is directly linked to reduced soil fertility and to a higher extent the incidence of pests and diseases. Consequently, Bosello, Campagnolo, Cervigni and Eboli in Nnadi et al.(2021) submitted that climate change negatively impacted agricultural production in Nigeria with production losses and increase in crop prices, higher food dependency on foreign imports and Gross Domestic Product (GDP) losses. Hence, the need to examine the farmers' climate change adaptation strategies and cassava production in Akoko South West Local Government Area, Ondo State.

The study examined farmers' climate change adaptation strategies and cassava production in Akoko South West Local Government Area, (LGA) Ondo State.
Specifically, the study: i. examined the climate change events noticed by the cassava farmers and the level of occurrence; ii. indicated the strategies cassava farmers adopt to combat the effect of climate change and their level of use; iii. determined the factors that influenced farmers' choice of adaptation strategies; and iv. identified the effects of climate change adaptation strategies used by farmers on cassava production. The study hypothesized that there is no significant relationship between climate change adaptation strategies and cassava production in the study area

Methodology

The study was conducted in Akoko South West LGA, Ondo State. Akoko Southwest is a local government area in Ondo state, Nigeria. It is located on Latitude 7.45439 and Longitude 5.80164 7° 27'16"North, 5° 48' 6" East with its headquarters at Oke Oka. It has an area of 226km^2 and a population of 239, 486 (NPC, 2006). Farming is the major occupation of the people in this area.

The population of the study comprised cassava farmers in Akoko South-West Local Government Area, Ondo state. Five (5) communities, Oka Akoko, Supare, Iwaro-Oka, Oba and Akungba-Akoko were selected from the local government area using a simple random sampling technique; this was followed by a systematic selection of 24 cassava farmers from each of the communities at the interval of 5 making a total of 120 respondents for the study. A

quantitative method of data collection was adopted for the study. Experts in the fields of agricultural extension and rural development face-validated the questionnaires. The reliability of the instrument was determined through the split-half method. A reliability coefficient of (r≥) 0.70 was obtained and was considered good to establish the reliability of the instrument.

To measure climate change events noticed by the farmers and the level of occurrence, respondents were asked to respond 'yes' or 'no' to a list of 14 climate change parameters. A score of 1 was attached to yes while 0 was attached to no. For yes the level of occurrence was rated on a three-point scale of frequently, moderately and occasionally.

To measure climate change adaptation strategies and level of use, respondents were asked to indicate the climate change adaptation strategies they use from a list of 14 elements and rate their level of use as high moderate or low. To measure actors influencing the respondents' choice of adaptation strategies, respondents were asked to indicate the factors affecting their choice of adaptation strategies from a list of 13 factors and these were ranked according to their frequency. Respondents' perception of the effect of their climate change adaptation strategies on cassava production was measured by asking the respondents to respond to 14 statements on a five-point Likert scale of strongly agreed, agreed undecided, disagreed and disagreed. The cut-off point of ≥4.0 was used. Data collected were coded and analysed using IBM-SPSS version 24. Mean, percentages and (PPMC) were used to analyse data.

Results and Discussion

Climate change events noticed and the level of occurrence

The findings in Table 1 show that high temperature was the major climate change event noticed by the cassava farmers in the area. Also, many (62.9%) of the respondents agreed that high temperatures occurred frequently. High humidity was ranked the second major climate change event noticed in the area while reduction in rainfall days was ranked the third climate change noticed. Drought was ranked the fourth major climate change noticed among the farmers within the study area. This supports the findings of Omerkhil, et.al. (2020) that drought was a case which resulted from climate change in Afghanistan. The implication is that necessary adaptation strategies to mitigate these climate change events must be put in place by the stakeholders such as the policy planners, researchers, extension workers, government and the farmers.

Table 1: Climate change events noticed among the respondents and level of occurrence

Climate change events	Mean	Rank
High temperature	2.48	1st
High humidity	2.61	2nd
Reduction in rainfall days	2.07	3rd
Increased frequency of drought in recent decades	2.00	4th
Increased loss of soil nutrients	0.52	5th
Low temperature	0.30	6th
Wind dryness	0.28	7th
Incidence of sand dunes	0.26	8th
Low humidity	0.21	9th
Delayed rainfall	0.18	10th
Decrease in yearly amount of rainfall	0.18	10th
Prolonged and hotter dry season	0.17	10th
Intensity harmattan period	0.08	13th
Unfavorable sunlight	0.04	14th

Source: Field survey, 2023

Respondents' Climate change adaptation strategies and level of use

The result in Table 2 reveals that reduced use of inorganic fertilizer and pesticides ($\bar{x}$ =2.44) was the major adaptation strategy used in the study area, this is followed by planting different varieties of cassava ($\bar{x}$ = 2.17). Using climate forecasting to reduce production risk was ranked the third adaptation strategy by the farmers ($\bar{x}$ = 2.06) while planting of varieties that are resistant to pests and diseases ($\bar{x}$ = 2.00), praying for rain/ritual offerings ($\bar{x}$ = 1.90) and adequate spraying of farmlands ($\bar{x}$ =1.80) were ranked the fourth, fifth and sixth respectively. This is in line with the findings of Adeola, Baires, John and Nicolas (2017) who in a related study discovered that reduced use of inorganic fertilizer can reduce the impact of climate change on crop productivity. This suggests that the adaptation strategies identified by the cassava farmers must be incorporated into contemporary cassava planting policy and other farmers should be encouraged by relevant stakeholders especially the agricultural extension agents to adopt them.

Table 2: Climate change adaptation strategies and level of usage

Adaptation strategies	Mean	SD
Reduced use of inorganic fertilizers and pesticides	2.44	0.663
Planting different varieties of cassava	2.17	0.67
Using climate forecasting to reduce production risk	2.06	0.681
Planting of cassava varieties that are resistant to pest and diseases.	2.00	0.692
Praying for rain/ritual offering	1.90	0.71
Adequate spraying of farmlands	1.80	0.712
Crop diversification	1.70	0.72
Irrigation system to supplement inadequate rainfall	1.60	0.732
Managing water to prevent water logging, erosion and nutrient leaching where rainfall increases	1.60	0.744
Improved processing method	1.40	0.75
Timely harvest	1.30	0.761
Fertilizer adoption.	1.20	0.77
Multiple cropping	1.10	0.783
Changes in cropping pattern	0.96	0.79

Source: Field Survey, 2023

Perceived factors influencing farmers' choice of adaptation strategies

Furthermore, findings on Table 3 affirm farming experience (97.5%) as the major factor influencing the respondents' choice of climate change adaptation strategies. This implies that farmers who are highly experienced are more likely to choose a better adaptation strategy unlike cassava farmers with lesser experience. Wealth (96.7) was ranked the second factor that determines the choice of adaptation strategies, this implies that wealthy farmers will have all the financial assets required to choose good adaptation strategies unlike less-wealthy farmers. Access to credit or grants (94.2) was ranked the third factor influencing the choice of adaption strategies among the cassava farmers in the study area. This furthers affirms the earlier findings of Hezron et al. (2021), Juliette (2022) and Owoeye (2022) who confirmed the roles of experience and information in understanding and adoption of climate change. This shows that the three most important factors that can be used to motivate cassava farmers to adopt the identified climate change adaptation strategies are farming experience, wealth and access to credit facilities and must be factored into agricultural development activities.

Table 3: Factors influencing respondents' choice of adaptation strategies

Factors	Percentage	Rank
Farming experience	97.5	1st
Wealth	96.7	2nd
Access to credit/grants	94.2	3rd
Household size	88.3	4th
Access to fertilizer	87.5	5th
Tenure right/land ownership	86.7	6th
Training/ Capacity building	83.3	7th
Access to water	77.5	8th
Age	75.8	9th
Access to improve stems/seedlings	63.3	10th
Level of education	51.7	11th
Access to extension services	30	12th
Soil fertility	29.2	13th

Source: Field Survey, 2023

Perceived Effects of Adaptation Strategy on Cassava Production in the Study Area

The results in Table 4 point out that the respondents strongly agreed that timely harvest ($\bar{x}$ = 4.53) planting different cassava varieties to reduce the effects of climate change on cassava yields ($\bar{x}$ = 4.50) and planting of cassava varieties and species that are resistant to pests and diseases ($\bar{x}$ = 4.23) are the major adaptation strategies used to mitigate effects of climate change on cassava production in the study area. Meanwhile, some of the respondents agreed that improved cassava planting practices have no effects on climate change ($\bar{x}$ =3.57) and that multiple cropping and fertilizer adoption does not reduce the effects of climate change on cassava production in the study area ($\bar{x}$ = 3.43). The implication is that these major adaptation strategies have impacted their cassava production positively and therefore should be sustained by relevant stakeholders.

Table 4: Perceived effect of adaptation strategy on cassava production

Attitudinal statements	Mean	SD
The adaptation strategy has led to the timely harvest of my cassava	4.53	0.833
Planting different varieties of cassava helps to reduce the effects of climate change on cassava yields	4.50	0.841
I support the planting of cassava varieties and species resistant to pests and diseases.	4.23	0.934
Adequate spraying of the farmlands reduces effects of climate change on cassava yields.	4.17	0.962
I believe in using climate forecasting to reduce production risk on cassava production.	4.00	0.973
I manage water to prevent water logging, erosion and nutrient leaching when rainfall increases to minimize its effects on cassava production	4.00	0.98
I support changes in cropping pattern to reduce the effects of climate change on cassava production	3.97	0.921
Planting varieties resistant to pests & diseases does not reduce the effects of climate change on cassava farms	3.93	0.85
I don't support use of irrigation system to supplement inadequate rainfall for cassava production during longer dry season	3.93	0.94
I don't believe climate prediction is a good strategy for cassava production	3.87	0.953
Crop diversification doesn't reduce the effects of climate change on cassava production	3.87	0.89
Improved cassava planting practices has no effects on climate change	3.57	0.742
Multiple cropping doesn't reduce effects of climate change on cassava	3.43	0.81
Fertilizer adoption does not reduce the effects of climate change on cassava production	3.32	0.834

Source: Field Survey, 2023 **Mean≥ 4.0 = Favourable Perception

Conclusion and Recommendations

The identified climate adaptation strategies are reduced use of inorganic fertilizer and pesticides, planting different varieties of cassava and using climate forecasting to reduce production risk should be further harnessed by relevant stakeholders to mitigate the effect of climate change on cassava production. Factors that influenced the farmers' choice of the adaptation strategies are farming experience, wealth and access to credits should be prioritised by experts and cassava farmers in the country.

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