EFFECT OF CLIMATE VARIABILITY ON CASSAVA PRODUCTION CAPACITY IN UHUNMWONDE LOCAL GOVERNMENT AREA IN EDO STATE, NIGERIA

BY

Aboje Sunday ABAH
AGR1900001

DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION SERVICES
FACULTY OF AGRICULTURE
UNIVERSITY OF BENIN
BENIN CITY, NIGERIA

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BEING A PROJECT SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION SERVICES, FACULTY OF AGRICULTURE, UNIVERSITY OF BENIN, BENIN CITY IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE BACHELOR OF AGRICULTURE (B. AGRIC) (WITH OPTION IN AGRICULTURAL ECONOMICS AND EXTENSION SERVICES)

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CERTIFICATION

This is to certify that this project work was carried out by **Aboje Sunday ABAH (AGR1900001)** of the Department of Agricultural Economics and Extension Services, Faculty of Agriculture, University of Benin, Benin City.

25/04/2025

Dr. O. Igbinidu **Date**
(Project Supervisor)

28/04/25

Dr. J. Egbodion **Date**
(Head of Department, AER)

14/04/2025

DEDICATION

This project is dedicated to Almighty God, my source and strength for His omnipresence, love and faithfulness all through the course of my degree; And to my parents Mr. James and Mrs. Maria Abah for their love, guidance and unwavering support, and above all to my elder brother, Mr. Joseph Abah for his selflessness and for being an instrument in God's hands to ensure the success of this degree.

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ABSTRACT

Cassava is a crucial staple crop in Nigeria, playing a vital role in food security and rural livelihoods. However, climate variability—characterized by erratic rainfall, rising temperatures, and extreme weather events—poses significant challenges to cassava production. This study examines the effects of climate variability on cassava production capacity in Uhunmwonde Local Government Area of Edo State, Nigeria. Specifically, it aims to (1) describe the socioeconomic characteristics of cassava farmers, (2) estimate and compare local cassava yields with the national average, (3) examine the effect of socioeconomic and climatic variables, along with market price, on cassava yield; (4) identify adaptation strategies employed by farmers to mitigate the adverse impacts of climate variability; (5) highlight how respondents perceived climate variability to affect cassava production. Primary data were collected through a structured questionnaire administered to 100 cassava farmers, while secondary information was obtained from established sources such as the Food and Agriculture Organization and the World Bank. The data were analyzed using descriptive statistics, t-tests, and multiple regression models. Findings revealed that although local cassava yields are slightly lower than the national standard, the difference is not statistically significant. Capital investment emerged as a key determinant of yield, whereas climatic variables did not show a direct significant effect. These results underscore the need for enhanced financial support, improved agricultural practices, and robust extension services to build resilience against climate variability. The study provided valuable insights for policymakers and stakeholders aiming to secure cassava production under increasingly volatile climatic conditions.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Agriculture remains a critical component of the global economy, particularly in developing countries where it forms the backbone of food security, employment, and economic stability. Cassava (*Manihot esculenta* Crantz) is one of the most significant food crops in Sub-Saharan Africa, serving as a staple food for over 800 million people worldwide and providing livelihoods for millions of smallholder farmers (IITA, 2023). Nigeria is the world's largest producer of cassava, contributing approximately 20% of the global output (FAO, 2022). Cassava is highly valued not only for its role in food security but also for its adaptability to various climatic conditions and its potential for value-added products (IITA, 2023).

However, the production of cassava, like other agricultural activities, is highly susceptible to the effects of climate variability. Climate variability refers to variations in the mean state and other statistics (such as the occurrence of extremes) of the climate on all temporal and spatial scales beyond that of individual weather events (IPCC, 2021). These variations can significantly affect crop yields, alter growing seasons, and influence the incidence of pests and diseases. In recent years, Nigeria has experienced noticeable changes in climate patterns, including increased temperatures, unpredictable rainfall patterns, and extreme weather events such as floods and droughts (NiMet, 2023). These changes pose a substantial threat to agricultural productivity, particularly in regions where farming practices are predominantly rain-fed, and technological adaptation is minimal. In the context of cassava production, climate variability can lead to significant fluctuations in yield. Cassava, known for its drought tolerance, may still suffer from reduced productivity under prolonged dry spells or irregular rainfall, which can disrupt planting and harvesting schedules. Conversely, excessive rainfall can lead to waterlogged soils, increasing the risk of root rot and other diseases. Uhunmwonde is predominantly an agricultural community, with cassava as one of the primary crops cultivated by smallholder farmers. The area's reliance on rain-fed agriculture makes it especially vulnerable to the adverse effects of climate variability. Despite the importance of cassava to the local economy and food security, there is a paucity of research on how climate variability specifically affects cassava production in Uhunmwonde. Existing studies on climate change and agriculture in Nigeria have largely focused on broader national or regional levels, often overlooking the localized effects and the coping mechanisms employed by farmers at the grassroot level. This study aims to fill this gap by examining the effects of climate variability on cassava production capacity in Uhunmwonde, with a focus on the farmers' socioeconomic characteristics, cassava output compared to national yields, factor affecting yield of cassava production, and the coping strategies employed to mitigate these effects. By providing a detailed analysis of these factors, this study will contribute to the broader understanding of how climate variability affects cassava production in Nigeria. It will also offer valuable insights for policymakers, agricultural extension services, and development agencies seeking to enhance the resilience of cassava farmers in Uhunmwonde and similar regions to climate-related challenges.

1.2 Statement of Problem

Climate variability has emerged as a significant challenge to agricultural productivity worldwide, with notable effects on staple crops like cassava. In Nigeria, cassava is a vital crop for both food security and economic stability. However, recent changes in climate patterns, including altered rainfall regimes, rising temperatures, and increased frequency of extreme weather events, threaten the stability and productivity of cassava farming. This is particularly critical in Uhunmwonde Local Government Area of Edo State, where the majority of the population relies on cassava cultivation as their primary source of livelihood. Despite its importance, there is a limited understanding of how these climatic changes specifically impact cassava production in Uhunmwonde. To address this gap, it is essential to investigate the following research questions:

1. What are the socioeconomic characteristics of cassava farmers in Uhunmwonde Local Government Area, and how do these characteristics influence their adaptation to climate variability?
2. How does cassava output in Uhunmwonde compare to the average national yield, and what factors contribute to any observed discrepancies?
3. What factors affect cassava production in the study area?

4. How do cassava farmers in Uhunmwonde perceive the effects of climate variability on their production?
5. What coping strategies are employed by cassava farmers in Uhunmwonde to mitigate the effects of climate variability on their production, and how effective are these strategies?

1.3 Objectives of study

The main objective of this study is to examine the effects of climate variability on cassava production capacity in Uhunmwonde Local government Area of Edo state, Nigeria.

the specific objectives are to:

1. describe the socioeconomic characteristics of cassava farmers in the area
2. estimate and compare cassava yield between farmers yield and average national yield.
3. examine the effect of socioeconomic factors, exogenous climatic variables and price on the yield of cassava production in the study area.
4. highlight how respondents perceive climate variability to affect cassava production
5. identify adaptation strategies of farmers in mitigating the effects of climate variability on cassava production.

1.4 Hypothesis

There is no significant difference between the yield of cassava production in the study area and average national yield.

1.5 Justification of Study

Cassava is a major food crop in Nigeria, contributing significantly to food security and the livelihood of millions. However, its production is increasingly threatened by climate variability. While several studies have explored the effects of climate change on cassava production in different parts of Nigeria, there is limited research specifically focusing on Uhunmwonde Local Government Area of Edo State. Existing studies often examine broad regions or focus on general agricultural trends without going deeply into the unique challenges and coping strategies employed by farmers in this specific locality. Recent studies have shown that climate change affects cassava production across various regions of Nigeria (Olajide *et al.,* 2020; Adeola and Ojo, 2021), but there has been little focus on Uhunmwonde. Understanding the specific challenges faced by farmers here is important for developing solutions that fit their needs. This study will fill that gap by examining local conditions and strategies, making it highly relevant for improving cassava yields in the region.

The findings from this research will be useful to agricultural extension workers and policymakers, who can use the results to better support farmers. By highlighting the key factors that impact cassava production and the coping strategies farmers are using, this study will help to create more targeted support programs that strengthen cassava farming in Uhunmwonde and beyond.

CHAPTER TWO

2.0 LITERATURE REVIEW

Cassava (*Manihot esculenta*) is a critical food security crop in Nigeria, ranking among the top staple foods in terms of consumption and production. Nigeria is the world's largest cassava producer, with an estimated annual output of over 60 million metric tons (Food and Agriculture Organization [FAO], 2021). Cassava serves as a source of carbohydrates for millions of people and provides raw materials for industrial processing, contributing significantly to household income and national economic development (Egesi *et al.,* 2020). Despite its resilience to adverse environmental conditions compared to other staple crops, cassava production is increasingly being affected by climate variability, which disrupts planting seasons, alters rainfall patterns, and affects soil moisture availability (Jalloh *et al.,* 2021).

2.1 Conceptual Review

2.1.1 Climate Variability

Climate variability refers to short- and long-term fluctuations in climatic parameters such as temperature, precipitation, and humidity, often deviating from historical trends (Intergovernmental Panel on Climate Change [IPCC], 2022). Unlike climate change, which represents long-term shifts in global or regional climate patterns, climate variability encompasses seasonal and annual fluctuations that can significantly impact agricultural systems (WMO, 2021). Variations in rainfall and temperature have been identified as key determinants of crop performance, affecting growth cycles, pest infestations, and soil fertility (Oluwatusin & Adedayo, 2020).

In Nigeria, erratic rainfall patterns, prolonged dry spells, and increasing temperatures have been observed, posing a significant threat to smallholder farmers who rely on rain-fed agriculture (Akinbile *et al.,* 2021). These climatic changes influence crop yields and often lead to lower farm productivity and increased food insecurity (Nwafor et al., 2020).

2.1.2 Cassava Production Capacity

Cassava production capacity refers to the potential yield output of cassava farms, influenced by factors such as soil fertility, climatic conditions, farm management practices, and input availability (Adebayo *et al.,* 2019). The concept is critical in assessing how efficiently farmers can produce cassava under varying environmental conditions. Research has shown that Nigeria's cassava yield potential is often not fully realized, mainly due to suboptimal farm inputs, poor extension services, and climate-related disruptions (Okoruwa *et al.,* 2021). Studies suggest that while cassava is drought-tolerant, excessive rainfall, prolonged droughts, and rising temperatures can reduce yields by up to 30% (FAO, 2021). Therefore, analyzing climate variability's impact on cassava production capacity is essential for developing sustainable interventions.

2.1.3 Adaptation Strategies

Adaptation strategies in agriculture refer to the adjustments farmers make in response to climate variability to sustain crop production and farm livelihoods (Adger *et al.,* 2020). These strategies can be autonomous or planned, depending on whether they are farmer-led or policy-driven. In cassava farming, adaptation measures include: Use of drought-resistant cassava varieties (Eke-Okoro & Njoku, 2021). Improved soil and water conservation techniques such as mulching and contour farming (Nwosu *et al.,* 2022). Changing planting and harvesting dates to match shifting weather patterns (Adebayo *et al.,* 2019). Diversifying crop production to minimize risks associated with climate shocks (Oluwatusin, 2021). Studies have shown that effective adaptation strategies can enhance cassava resilience, ensuring stable yields even under unpredictable climatic conditions (Tijani & Tijani, 2022). However, adoption rates of these strategies are often constrained by factors such as limited access to credit, poor extension services, and lack of climate information (Agwu & Okoye, 2020).

2.1.4 Influence of Climate Factors on Cassava Yield

Cassava production is influenced by multiple climatic factors, primarily temperature, rainfall, and extreme weather events.

Temperature: Cassava grows optimally between 25°C and 30°C, and prolonged exposure to temperatures above 35°C can reduce tuber formation (FAO, 2021).

Rising temperatures have been linked to increased evapotranspiration and soil moisture loss, which negatively affect yield (Jalloh *et al.,* 2021).

Rainfall: Cassava requires moderate but well-distributed rainfall (1,000–1,500 mm annually) for optimal growth. Studies have found that excessive rainfall can lead to root rot, while prolonged droughts can reduce tuber development (Okoro *et al.,* 2020).

Extreme Weather Events: Events such as flooding, droughts, and storms have become more frequent, disrupting cassava farming cycles (Akinbile *et al.,* 2021). In Nigeria, flooding has been reported to destroy up to 40% of cassava farms in high-rainfall regions (Nwosu *et al.,* 2022). Given these climatic constraints, it is crucial for farmers to implement adaptive measures to mitigate yield losses and maintain cassava production sustainability.

2.2 Socioeconomic Characteristics of Cassava Farmers

2.2.1 Age

Age plays a significant role in agricultural productivity and the adoption of innovative farming practices. Studies indicate that a substantial proportion of cassava farmers in Nigeria are middle-aged. For instance, research in Osun State revealed that the mean age of cassava farmers was approximately 45.5 years (Omodara *et al.,* 2023). Similarly, a study in the Federal Capital Territory found that 43.9% of female-headed cassava farming households were aged between 41 and 50 years (Alabuja *et al.,* 2023). The predominance of middle-aged farmers suggests a blend of experience and physical capability, which can positively influence cassava production.

2.2.2 Gender

Gender dynamics significantly impact agricultural activities in Nigeria. While both men and women engage in cassava farming, certain studies highlight male dominance in specific regions. Omodara *et al.* (2023) reported that 78% of cassava farmers in Osun State were male. In contrast, research in the Federal Capital Territory indicated a higher involvement of females in cassava farming activities (Alabuja *et al.,* 2023). These variations underscore the importance of considering regional gender roles when developing agricultural policies and interventions.

2.2.3 Education

Educational attainment influences farmers' ability to adopt improved agricultural practices and adapt to climate variability. In the Federal Capital Territory, 86.8% of female-headed cassava farming households had primary education, while 13.2% had secondary education (Alabuja *et al.,* 2023). Higher educational levels are associated with better access to information and resources, facilitating the adoption of climate-resilient farming techniques.

2.2.4 Farm Size

Farm size is a critical determinant of production capacity. Studies have shown that farm size positively affects cassava output. Unaeze and Ihunwo (2021) found that larger farm sizes were associated with increased cassava production. However, the average farm size among cassava farmers is often small. For example, in the Federal Capital Territory, 88.3% of farmers operated on less than one hectare of land (Alabuja *et al.,* 2023). Small farm sizes may limit economies of scale and mechanization, potentially affecting productivity.

2.2.5 Labor Use

Labor is a vital input in cassava production, with family labor being predominant. Research indicates that 70% of cassava farmers have household sizes ranging from 6 to 10 people, providing a substantial labor force for farming activities (Alabuja *et al.,* 2023). The reliance on family labor underscores the importance of household composition in sustaining cassava production.

2.2.6 Income

Income levels among cassava farmers vary, influencing their capacity to invest in improved farming practices. In the Federal Capital Territory, the mean annual income for female-headed cassava farming households was approximately ₦374,868 (Alabuja *et al.,* 2023). Higher income levels enable farmers to procure better inputs, access credit facilities, and adopt technologies that can enhance productivity and resilience to climate variability.

2.2.7 Farming Experience

Experience in farming contributes to effective decision-making and adaptation strategies. The mean farming experience among female-headed cassava farming households in the Federal Capital Territory was about 19.7 years (Alabuja *et al.,* 2023). Extensive farming experience equips farmers with the knowledge to implement effective adaptation measures in response to climate variability.

2.3 Cassava Yield Comparison: Farmers vs. National Standard

2.3.1 Factors Contributing to Yield Variations

Several factors contribute to the observed variations in cassava yields:

Climate Variability: Cumulative radiation and precipitation are significant determinants of cassava yield variability. Adequate sunlight and rainfall are essential for optimal growth, and deviations from these can adversely affect yields (Srivastava *et al.,* 2022).

Soil Fertility: Nutrient limitations account for approximately 55.3% of the total cassava yield gap in Nigeria. Poor soil health, characterized by nutrient deficiencies, significantly hampers cassava productivity (Srivastava *et al.,* 2022).

Farming Practices: The adoption of improved cassava varieties and modern agricultural practices is inconsistent. In Ogun State, about 85% of farmers were aware of improved varieties, yet only 40% adopted recommended planting times, spacing, and weeding practices. Fertilizer usage was about 25%, and herbicide adoption was less than 1% (FAO, n.d.). These low adoption rates contribute to suboptimal yields.

Farm Inputs: High costs and limited access to quality agricultural inputs, such as fertilizers and pesticides, deter farmers from utilizing them, leading to reduced yields (Cassava Starch Machine, n.d.).

Weed Management: Weed competition is a major biological stress affecting cassava production. Effective weed management strategies, including the use of appropriate herbicides and cultivation practices, are crucial for enhancing yields (Chikoye et al., 2021).

2.4 Effect of Socioeconomic and Climatic Variables and Price on Cassava Yield

2.4.1 Socioeconomic Variables

Capital and Labor Cost: Adequate capital investment is essential for procuring quality inputs and adopting improved farming practices. However, many cassava farmers in Nigeria face financial constraints, limiting their productivity. Labor costs also constitute a significant portion of production expenses, and fluctuations in labor availability and wages can impact cassava yield (Ajayi, 2015).

Education Level: The educational attainment of farmers plays a pivotal role in the adoption of modern agricultural techniques. Studies have shown that higher education levels correlate with increased technical efficiency in cassava production. Educated farmers are more likely to implement improved practices, leading to enhanced yields (Ajibefun & Aderinola, 2004).

Farm Size and Experience: Farm size has been identified as a significant determinant of cassava output. Larger farms benefit from economies of scale, enabling more efficient resource utilization. Additionally, farming experience contributes to better decision-making and adaptation to changing conditions, thereby positively influencing yield (Ajibefun & Aderinola, 2004).

2.4.2 Climatic Variables

Rainfall and Temperature Fluctuations: Cassava is sensitive to climatic conditions, particularly rainfall and temperature. Adequate and well-distributed rainfall is crucial for optimal growth, while temperature extremes can adversely affect physiological processes. Variability in these factors has been linked to fluctuations in cassava yield (Ajayi, 2015).

Droughts and Extreme Weather Events: Extreme weather events, including droughts, pose significant threats to cassava production. Drought conditions can lead to water stress, reducing tuber development and overall yield. The increasing frequency of such events due to climate change necessitates the adoption of resilient farming practices (Ajayi, 2015).

2.4.3 Market Price

Input Costs: The costs of inputs such as fertilizers and herbicides directly influence farmers' ability to invest in their crops. High input prices can deter adequate application, leading to suboptimal yields. Conversely, affordable inputs encourage better crop management practices (Ajayi, 2015).

Selling Prices: Market prices for cassava products affect farmers' income and their capacity to reinvest in production. Fluctuations in selling prices can influence decisions on the scale of production and the adoption of yield-enhancing technologies. Stable and favorable market conditions are essential for motivating farmers to improve productivity (Ajayi, 2015).

2.5 Adaptation Strategies to Climate Variability

Cassava farmers in Nigeria employ various adaptation strategies to mitigate the adverse effects of climate variability. These strategies are crucial for sustaining cassava production and ensuring food security in the face of changing climatic conditions. This section reviews common adaptation practices, including the adoption of drought-resistant cassava varieties, soil conservation and water management techniques, crop diversification and mixed cropping systems, and adjusting planting schedules based on climate forecasts.

2.5.1 Adoption of Drought-Resistant Cassava Varieties

The selection and cultivation of drought-resistant cassava varieties have been pivotal in enhancing resilience against erratic rainfall patterns and prolonged dry spells. Improved cultivars are bred to withstand water stress, thereby maintaining yield stability under adverse conditions. In seasonally dry and semi-arid environments with less than 700 mm of annual rainfall, these improved varieties have demonstrated dry root yields exceeding 3 tonnes per hectare (El-Sharkawy, 2006).

This practice has been widely adopted among cassava farmers as a proactive measure against climate-induced yield fluctuations.

2.5.2 Soil Conservation and Water Management Practices

Effective soil conservation and water management are essential for maintaining soil health and ensuring adequate moisture availability for cassava crops. Farmers implement techniques such as mulching, contour farming, and the construction of ridges to reduce soil erosion and enhance water retention. These practices not only mitigate the impacts of heavy rainfall and droughts but also improve soil fertility, leading to increased cassava productivity. The adoption of these measures reflects a strategic response to the challenges posed by climate variability on soil and water resources.

2.5.3 Crop Diversification and Mixed Cropping Systems

Diversifying crops and engaging in mixed cropping systems serve as risk management strategies against climate variability. By cultivating a variety of crops alongside cassava, farmers can buffer against the failure of any single crop due to adverse weather events. This approach enhances food security and provides multiple sources of income. In Delta State, Nigeria, a significant proportion of cassava farmers have adopted climate-smart agricultural practices, including crop diversification, to adapt to changing climatic conditions (Goodluck *et al.,* 2023). Such diversification reduces vulnerability to climate-induced stresses and promotes sustainable agricultural systems.

2.5.4 Adjusting Planting Schedules Based on Climate Forecasts

Aligning planting schedules with climate forecasts enables farmers to optimize the growth conditions for cassava. By adjusting planting and harvesting dates in response to predicted weather patterns, farmers can avoid periods of extreme temperatures and inadequate rainfall. This practice has been reported among cassava farmers as an effective adaptation strategy to climate variability (Nwaiwu *et al.,* 2021). Utilizing meteorological information to inform agricultural planning helps in minimizing the risks associated with climate unpredictability and enhances the resilience of cassava production systems.

2.6 Farmers' Perception of Climate Variability

Cassava farmers in Nigeria have reported noticeable changes in climatic patterns, which they believe adversely affect cassava production. A study conducted in Kuje Area Council, Abuja, revealed that farmers perceived increased temperatures (45%), reduced crop yields (43%), more frequent droughts (59%), and heightened instances of flooding (63%) as significant challenges to cassava farming (Paul *et al.,* 2022). Similarly, research in Ogun and Kwara States found that 65.41% of farmers viewed climate variability as unpredictable weather patterns over the years, while others attributed it to divine acts (23.31%) or divine retribution (11.28%) (Adejuwon *et al.,* 2021). These perceptions underscore the awareness among farmers of the tangible impacts of climate variability on agricultural productivity.

2.6.1 Survey-Based Approaches to Assessing Farmer Perceptions

Researchers have employed various survey-based methodologies to gauge farmers' perceptions of climate variability:

Structured Interviews and Questionnaires: In Kuje Area Council, structured interviews were utilized to collect data from 100 cassava farmers, revealing significant concerns about increased temperatures and the frequency of extreme weather events affecting cassava yields (Paul *et al.,* 2022).

Focus Group Discussions (FGDs): In Ogun and Kwara States, FGDs provided a platform for farmers to express their experiences and perceptions of climate variability, highlighting a consensus on the unpredictability of weather patterns and their adverse effects on cassava production (Adejuwon *et al.,* 2021).

These methodologies facilitate a comprehensive understanding of farmers' views, enabling the development of targeted adaptation strategies.

2.7 Theoretical Framework

This study is underpinned by several theoretical frameworks that elucidate the interactions between climate variability, agricultural practices, and farmer decision-making. The primary theories include the Sustainable Livelihoods Framework (SLF), the Ricardian Model of Climate Change and Agriculture, and the Theory of Planned Behavior (TPB). These frameworks provide a comprehensive understanding of how cassava farmers in Nigeria perceive and adapt to climate variability, influencing their productivity and sustainability.

2.7.1 Sustainable Livelihoods Framework (SLF)

The SLF offers a holistic approach to understanding how rural households utilize various assets and strategies to achieve sustainable livelihoods amidst vulnerabilities such as climate variability. It emphasizes the role of five capital assets—human, social, natural, physical, and financial—in shaping livelihood outcomes (DFID, 1999). In the context of cassava farming, the SLF helps analyze how farmers leverage these assets to implement adaptation strategies, thereby enhancing resilience to climate risks. Empirical studies have applied the SLF to assess community resilience to climate change. For instance, Osman-Elasha *et al.* (2005) utilized the SLF to evaluate how communities in Sudan adapt to climate-induced stressors, highlighting the importance of asset diversification and social networks in building adaptive capacity. Similarly, an integrated analytical framework combining the SLF with other models has been employed to diagnose vulnerability and identify adaptation options in rural settings (Harrison *et al.,* 2015).

2.7.2 Ricardian Model of Climate Change and Agriculture

The Ricardian model assesses the economic impact of climate change on agriculture by examining the relationship between land values or net revenues and climatic variables. This approach accounts for farmers' adaptive behaviors, providing insights into how changes in temperature and precipitation influence agricultural productivity and profitability (Mendelsohn *et al.,* 1994). Several studies have employed the Ricardian model to evaluate climate change impacts on agriculture. Mendelsohn et al. (2000) applied this model to analyze African cropland, revealing that variations in climate significantly affect net farm revenues. In the Mediterranean region, specifically Southern Italy, the Ricardian approach has been used to assess the expected impact of climate change on permanent crops, indicating potential shifts in agricultural profitability due to warming (Di Falco *et al.,* 2019).

2.7.3 Theory of Planned Behavior (TPB)

The TPB posits that an individual's intention to perform a behavior is influenced by their attitude toward the behavior, subjective norms, and perceived behavioral control (Ajzen, 1991). In agricultural contexts, the TPB has been utilized to understand farmers' intentions to adopt climate-smart practices. Factors such as beliefs about the benefits of adaptation strategies, social pressures, and perceived ease or difficulty of implementation play crucial roles in shaping these intentions. Studies have applied the TPB to explore the determinants of farmers' adoption of sustainable practices. For example, research indicates that positive attitudes toward climate-smart agriculture, supportive social norms, and a strong sense of control over farming activities enhance the likelihood of adopting adaptive measures (Niles *et al.,* 2016). Understanding these behavioral intentions is vital for designing interventions that encourage the uptake of effective adaptation strategies among cassava farmers facing climate variability.

2.8 Empirical Review

2.8.1 Effects of Climate Variability on Cassava Production

Several studies have investigated the impact of climatic factors on cassava yield in Nigeria:

Impact of Greenhouse Gases and Rainfall: A study by Eze *et al.* (2023) analyzed the long-term effects of arable land, rainfall, and greenhouse gases on cassava yield. The findings indicated that while temperature was not a significant factor, variables such as arable land, rainfall, and greenhouse gases (CO_2, N_2O, CH_4) significantly influenced cassava yield. Notably, methane (CH_4) was found to have a detrimental effect, causing more long-term damage to cassava yield than other greenhouse gases and climatic variables.

Climate Variability and Food Security: Oyita *et al.* (2022) examined the relationship between climate variability, cassava output, and food security in Nigeria from 1990 to 2020. The study focused on major climatic variables and their influence on cassava production, highlighting the critical role of stable climatic conditions in ensuring food security.

Agro-Climato-Edaphic Zonation: Research by Okechukwu *et al.* (2020) emphasized the importance of soil conditions, sunshine hours, and rainfall in determining the suitability of locations for cassava cultivation in Nigeria. The study provided insights into how these factors influence cassava yield across different regions. Farmer Perceptions of Climate Variability: Adejuwon *et al.* (2021) explored cassava-based farmers' perceptions of climate variability in Ogun and Kwara States. The study revealed that a significant proportion of farmers perceived climate variability as unpredictable weather patterns, while others attributed it to divine acts. These perceptions influence their adaptive strategies and highlight the need for targeted interventions. Climatic Factors Influencing Cassava Output: Research by Olanrewaju *et al.* (2021) assessed the impact of climatic variability on cassava output in Nigeria. The study identified annual rainfall and solar radiation as key factors influencing cassava production across various agro-ecological zones, underscoring the importance of these climatic elements in agricultural planning.

2.8.2 Research Methodologies

The methodologies employed in these studies predominantly include:

Time-Series Analysis: Utilized to examine long-term data on climatic variables and cassava yield, allowing researchers to identify trends and correlations over extended periods.

Survey-Based Approaches: Employed to gather data on farmers' perceptions and adaptive strategies, providing qualitative insights that complement quantitative findings. Agro-Climatic Zonation Techniques: Applied to classify regions based on climatic and soil characteristics, aiding in the identification of suitable areas for cassava cultivation.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Area and Scope

The study was conducted in Edo State, located in the southern region of Nigeria. Edo State covers approximately 17,802 square kilometers and comprises 18 local government areas. It is bordered by Kogi State to the north and northeast, Delta State to the south, and Ondo State to the west. Agriculture plays a vital role in the economy of Edo State, with cassava being one of the major food crops cultivated in the region. The state experiences a tropical climate, characterized by a rainy season (April to October) and a dry season (November to March), with annual rainfall between 1500 mm and 2500 mm. Average temperatures range from 25°C to 35°C throughout the year.

The specific focus of this study is Uhunmwonde Local Government Area, which spans about 2,033 square kilometers. Uhunmwonde is predominantly a rural area where cassava farming serves as a major economic activity. Like other parts of Edo State, Uhunmwonde experiences climate variability, with irregular rainfall patterns and increasing temperatures impacting cassava production. Both Edo State and Uhunmwonde face climatic challenges that directly affect agricultural productivity. Climate variability, such as unpredictable rainfall and prolonged dry spells, disrupts planting and harvesting cycles, leading to inconsistent cassava yields. The scope of this study is to examine how these climatic conditions affect cassava farming in Uhunmwonde and the strategies farmers adopt to mitigate these effects.

3.2 Population of the Study

The population for this study consisted of cassava farmers residing in Uhunmwonde Local Government Area (LGA) of Edo State, Nigeria.

3.3 Sampling Techniques and Sample Size

A multi-stage sampling procedure was employed to select a representative sample of cassava farmers in Uhunmwonde Local Government Area (LGA). Firstly, a purposive sampling technique was used to select communities within the Uhunmwonde LGA that are known for cassava production. This was based on the researcher's knowledge of this community being a cassava producing community. In the second stage, 5 communities were randomly selected using a ballot box method and finally the random selection of 20 ADP registered cassava farmers with Edo State making a sample size of 100 cassava farmers.

3.4 Measurement of Variables

3.4.1 Dependent Variable

Cassava Yield (kg/ha): Was measured as the total quantity of cassava harvested (in kilograms) per hectare of land cultivated by each farmer. This allows for comparison of yields between different farms and against national averages.

3.4.2 Independent Variables

A. Climatic Variables

Rainfall Variability: Historical rainfall data from meteorological sources was used to assess variations in rainfall over time and will be measured in millimeters (mm).

Temperature Changes: Similar to rainfall, temperature variations were measured in degree Celsius (°C) using meteorological data.

B. Socio-economic characteristics.

1. Age of Farmer: Was measured in years.
2. Gender: Was recorded as a binary variable (1 for male, 0 for female).
3. Educational Level: Was measured in years.
4. Farm Size: was measured in hectares as a continuous variable.
5. Household size: was measured by number of persons per household.
6. Farming Experience: was measured in years.
7. Access to Extension Services: was measured as a binary variable (1 = yes, 0 = no), indicating whether the farmer receives support from agricultural extension officers.
8. Coping Strategies: Farmers' adaptation strategies (e.g., use of drought-tolerant varieties, irrigation, changing planting dates) was measured as a nominal variable, with farmers selecting from a list of options.

3.5 Data Collection

Data collection for this study involved gathering both primary and secondary data to comprehensively assess the effect of climate variability on cassava production in Uhunmwonde Local Government Area (LGA). The primary data were collected by the administration of a properly structured questionnaire to cassava farmers. Secondary information were gathered from the various secondary sources comprising Food and Agriculture Organization Statistical database (FAOSTA), World Bank database, Central Bank of Nigeria statistical Bulletin and the International Institute of Tropical Agriculture (IITA) and they cover 2010 - 2023.

3.6 Analytical Technique

Objective 1: The socioeconomic characteristics of cassava farmers was analyzed using descriptive statistics such as percentages, means, and standard deviations.

Objective 2: The cassava output of farmers in the study area and the average national yield was estimated and compared using a t-test.

Objective 3: Factors affecting the yield of cassava production was analyzed using Structural Ricardian analytical model to determine the influence of various independent variables on the yield of cassava production. The model is specified below:

$$LogYit = \beta_0 + \beta_1 log(Lit) + \beta_2 log(Ait) + \beta_3 log(Fit) + \beta_4 log(Kit) + \beta_5 log(Rit) + \beta_6 log(Tit) + \beta_7 log(Hit) + \beta_8 log(Pit) + e \quad (3.1)$$

Where;

Y = Yield

L = Labour (man-days per hectare)

A = Area planted (hectares)

F = fertilizer (kg)

K = Capital (Capital depreciation in naira)

R = Rainfall (mm)

T = Temperature (^oC)

H = Herbicide (hectare)

P = price of cassava

β = Coefficient to be estimated

e = stochastic variable

Objective 4: A four-point Likert-like scale was used to capture the perceptions of cassava farmers about how climate variability affects their production.

Objective 5: Coping strategies employed by farmers to mitigate the effects of climate variability was analyzed using descriptive statistics like frequency counts, percentages, and ranking of strategies based on their effectiveness.

3.7 Test of Hypotheses

Null Hypothesis: There is no significant difference between the yield of cassava production in the study area and the average national yield. This hypothesis was tested using a **t-test** for independent samples to compare the mean cassava yield in Uhunmwonde to the national average yield.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socioeconomic Characteristics of Respondents

4.1.1 Sex Distribution of Respondents

The results in Table 4.1 indicate that 51% of cassava farmers were male, while 49% were female. This suggests that cassava farming in the study area is nearly gender-balanced, with both men and women actively participating. This finding aligns with the work of Omoregie and Aziken (2022), who reported similar male-to-female participation in cassava production in Delta State. The relatively high female involvement may be linked to the fact that cassava processing, a key aspect of the value chain, is often dominated by women (Apata, 2019).

4.1.2 Age Distribution of Respondents

The results of Table 4.1, also showed that majority (48%) of respondents were between 39–48 years, with a mean age of 42 years. This suggests that middle-aged farmers dominate cassava farming in Uhunmwonde. This is consistent with the findings of Ologbon *et al.* (2021), who observed that cassava farming in South-South Nigeria is largely carried out by individuals within the 35–50-year age range. The relatively low proportion of younger farmers may be due to rural-urban migration and limited youth interest in farming (Andrew *et al.,* 2023).

4.1.3 Marital Status of Respondents

The results show that 81% of respondents were married, while 14% were single and 5% widowed. This indicates that a significant proportion of cassava farmers are married, which aligns with findings by Ehilenboadiaye *et al.* (2021), who reported that most married individuals engage in farming primarily to support their families. This also suggests that household responsibilities may influence cassava production choices and farm labor availability.

4.1.4 Educational Level of Respondents

Education plays a crucial role in agricultural productivity and the adoption of improved farming practices. The results in table 1 show that 40% of respondents had secondary education, while 26% completed primary education, and only 9% attained tertiary education. This suggests that most farmers have basic literacy skills, which could influence their ability to adopt climate-smart agricultural practices. This observation is in line with Anyiro and Oyeamachi (2014), who emphasized that higher education enhances farmers' ability to access and process agricultural information.

4.1.5 Household Size of Respondents

The result of the study revealed that 66% of farmers had household sizes ranging from 6–10 members, with a mean household size of 6 persons. Large household sizes suggest potential for higher family labor availability, which is important for cassava farming, given its labor-intensive nature. This finding is consistent with Okpara

(2011), who noted that larger households often contribute significantly to farm labor supply in smallholder farming systems.

4.1.6 Farming Experience of Respondents

The results show that 44% of respondents had between 11–20 years of farming experience, with an average of 15 years. This indicates that most cassava farmers are highly experienced, which may positively influence farm productivity. Similar results were reported by Tijani and Tijani (2019), who found that farming experience improves decision-making, adoption of improved techniques, and yield performance.

4.1.7 Farm Size of Respondents

The results show that majority (100%) of cassava farmers cultivated less than 1 hectare, with a mean farm size of 0.47 hectares. This suggests that cassava farming in Uhunmwonde is dominated by smallholder farmers, which may limit mechanization and large-scale production. Okoruwa *et al.* (2020) found that small farm sizes remain a key challenge in cassava production, as they restrict farmers' ability to scale operations and increase output.

4.1.8 Nature of Farm Ownership of Respondents

The results show that 47% of cassava farmers operated within cooperatives, while 34% practiced family-owned farming, and 19% engaged in sole proprietorship farming. The dominance of cooperative-based farming suggests that farmers rely on group resources and shared labor, which has been linked to increased efficiency in cassava production (Nwafor, 2019).

4.1.9 Cropping Pattern of Respondents

The findings indicate that 49% of farmers practice sole cropping, while 49% engage in mixed cropping, and only 2% use crop rotation. This result suggests that cassava farmers adopt both specialized and diversified farming approaches. Studies by Adeola and Ojo (2021) highlight that mixed cropping is commonly used to mitigate risks associated with climate variability.

4.1.10 Sources of Income of Respondents

The results showed that 97% of farmers rely primarily on farming as their source of income, with only 2% engaged in business and 1% earning from salary jobs. This finding underscores the economic dependence of rural households on cassava production, a trend also reported by Adisa *et al.* (2013), who found that rural economies in Nigeria are heavily reliant on agriculture.

4.1.11 Sources of Loans of Respondents

The study also showed that the majority of farmers (59.18%) accessed loans through cooperative societies, while 22.45% benefited from government schemes, and only 14.28% received bank loans. This suggests that access to formal credit remains limited, a key constraint to agricultural investment. Nwafor (2019) also noted that cassava farmers in Nigeria often struggle with securing financial support from formal banking institutions.

Table 4.1: Socioeconomic characteristics:

Variables	Freq.	Perc	Mean
Sex			
Male	51	51.00	
Female	49	49.00	
Age			
29-38	28	28.00	
39-48	48	48.00	42
49-58	24	24.00	
Household size			
1-5	34	34.00	6
6-10	66	66.00	
Farming experience			
1-10	30	30.00	
11-20	44	44.00	15
21-30	26	26.00	
Farm size			
0-0.5	59	59.00	
0.51-1.0	41	41.00	0.47
Marital status			
Single	14	14.00	
Married	81	81.00	
Widowed	5	5.00	
Level of Education			
Non formal	25	25.00	
Primary	26	26.00	
Secondary	40	40.00	
Tertiary	9	9.00	
Nature of farm			
Sole proprietorship	19	19.00	
Family	34	34.00	
Cooperative	47	47.00	

Cropping pattern		
Sole cropping	49	49.00
Mixed cropping	49	49.00
Crop rotation	2	2.00
Source of income		
Farming	97	97.00
Business	2	2.00
Salary job	1	1.00
Sources of loan		
Bank	7	14.28
Cooperative	29	59.18
Government scheme	11	22.45
Family and friends	2	4.09

Source: Field survey, 2025

4.2 The Results of Cassava Yield and National Average Yield

The results in Table 4.2 showed the distribution of cassava yield among farmers in the study area. The findings reveal that 24% of farmers harvested between 5–10 tons per hectare while 33% of farmers harvested between 11–20 tons per hectare and 43% of farmers harvested more than 20 tons per hectare. The mean cassava yield per hectare in the study area was 24.3 tons, while the national average yield is 30 tons. The t-test value of 1.47 indicates that there is no statistically significant difference between the cassava yield in the study area and the national average at the 5% significance level. This suggests that, although local farmers produce slightly less than the national average, the difference is not significant to conclude that yield in the study area is much lower. These findings are similar to those of Adepoju and Salami (2021), who found that cassava farmers in Nigeria often achieve yields below the national average due to challenges such as limited access to improved planting materials and poor soil management practices.

Table 4.2: Comparison with national average

Cassava harvested per hectare per season	Freq	percentage	National average	T. statistics
<5	-	-		
5-10	24	24.00		
11-20	33	33.00		
>20	43	43.00		
Mean	$\bar{x}$=24.3		$\bar{x}$=30 tons	1.47

Source: computed from field survey, 2025

4.3 Socioeconomic Factors, Exogenous Variables and Price Influencing Cassava Yield

Table 3 showed the results of a regression analysis examining the factors influencing cassava yield in the study area. The results showed the relationships between different independent variables (capital, price of cassava, farm size, labor cost, age, farming experience, rainfall, and temperature) and cassava yield.

4.3.1 Capital

The coefficient for capital is 0.131, with a t-value of 11.97 and a p-value of 0.000, indicating a statistically significant positive relationship between capital and cassava yield at the 1% significance level. This suggests that higher capital investment in cassava farming leads to increased productivity. Similar findings were reported by Adepoju and Salami (2021), who noted that access to capital enhances farmers' ability to purchase improved inputs, hire labor, and invest in better farming technologies.

4.3.2 Price of Cassava

The coefficient for the price of Cassava is -0.237, with a t-value of -0.78 and a p-value of 0.440. Since the p-value is greater than 0.05, the relationship is not statistically significant. This implies that fluctuations in the price of cassava do not have a direct significant effect on cassava yield. Nwafor *et al.* (2020) also found that while input costs affect farmers' financial decisions, the price of Cassava alone does not significantly alter yield levels.

4.3.3 Farm Size

The coefficient for farm size is -8897.021, with a t-value of -1.69 and a p-value of 0.094. This result is not statistically significant at the 5% level, indicating that farm size does not strongly influence cassava yield in the study area. However, other studies, such as Tijani and Tijani (2021), have reported that farm size can have varying effects depending on access to mechanization and farm inputs.

4.3.4 Cost of Labor

The coefficient for labor cost is -0.379, with a t-value of -1.54 and a p-value of 0.128. This suggests that labor cost has a negative but statistically insignificant effect on cassava yield. Ogunleye *et al.* (2019) found that high labor costs can reduce profitability, but their direct impact on yield is often dependent on farm management efficiency.

4.3.5 Age

The coefficient for age is 290.452, with a t-value of -1.50 and a p-value of 0.138, indicating that age has no statistically significant effect on cassava yield. This is in line with the findings of Ologbon *et al.* (2021), who observed that while age can influence experience levels, it does not directly impact cassava output.

4.3.6 Farming Experience

The coefficient for farming experience is -36.892, with a t-value of -1.53 and a p-value of 0.130. The negative coefficient suggests that more experienced farmers may not necessarily achieve higher cassava yields. This contradicts the common assumption that experience leads to better yield management, as noted by Okoro and Adebayo (2022).

4.3.7 Rainfall and Temperature

Rainfall: The coefficient is 30.621, with a t-value of 0.61 and a p-value of 0.330, indicating that rainfall does not have a significant impact on yield.

Temperature: The coefficient is 25.321, with a t-value of 0.72 and a p-value of 0.251, showing that temperature also does not have a significant impact on cassava yield.

These findings suggest that climate variability alone does not significantly determine yield levels, but rather, a combination of factors, including farm inputs and management practices, play a more critical role. Adepoju and Salami (2021) noted that cassava is relatively resilient to climatic fluctuations compared to other staple crops, which may explain why rainfall and temperature changes do not show a strong statistical effect in this study.

Table 4.3: Factors influencing Cassava yield

Variables	Coefficient	t	P(t)
Capital	0.131	11.97	0.000
Price of cassava	-0.237	-0.78	0.440
Farm size	-8897.021	-1.69	0.094
Cost of labor	-0.379	-1.54	0.128
Age	290.452	-1.50	0.138
Farming experience	-36.892	-1.53	0.130
Rainfall	30.621	0.61	0.330
Temperature	25.321	0.72	0.251

Source: computed from field survey, 2025

4.4 Respondent's Perception of Factors Affecting Cassava Yield

The results of table 4 showed the respondents' perceptions of the factors influencing cassava yield in the study area. The results reveal the following:

4.4.1 Age and Gender

The vast majority of respondents (99%) believe that age and gender do not significantly influence cassava yield, with only 1% indicating otherwise. This suggests that yield performance is not necessarily dependent on the farmer's age or gender but rather on other factors such as farm management practices, input use, and access to resources. Studies by Adepoju and Salami (2021) found similar results, showing that productivity differences in cassava farming are primarily influenced by technical efficiency rather than demographic factors.

4.4.2 Level of Education

A near-equal split was observed regarding the role of education in cassava yield, with 49% of farmers believing education influences yield, while 51% do not. This suggests a mixed perception, where some farmers recognize the importance of education in adopting improved agricultural practices, while others may rely more on experience and indigenous knowledge. Okoro and Adebayo (2022) reported that while education enhances access to agricultural information, its direct impact on cassava yield depends on the willingness of farmers to adopt modern techniques.

4.4.3 Farm Size

A significant 98% of farmers stated that farm size influences cassava yield, while only 2% disagreed. This result is expected, as larger farms typically allow for greater production capacity and economies of scale. This finding aligns with Nwafor et al. (2020), who reported that farm size is a critical determinant of cassava productivity in Nigeria, as larger landholdings provide opportunities for mechanization and higher yields per hectare.

4.4.4 Household Size

Only 8% of respondents believe household size affects cassava yield, while 92% do not. This suggests that while family labor is an essential component of smallholder farming, it may not be the most significant factor influencing yield. This contrasts with the findings of Tijani and Tijani (2021), who suggested that larger households contribute to increased labor availability, potentially improving yield outcomes.

4.4.5 Farming Experience

An overwhelming 99% of farmers believe that farming experience significantly influences cassava yield, while only 1% disagreed. This aligns with findings from Ogunleye *et al.* (2019), who noted that experienced farmers tend to make better decisions regarding planting periods, pest control, and soil fertility management, leading to improved cassava productivity.

4.4.6 Extension Services

A total of 51% of respondents agreed that extension services influence cassava yield, while 49% did not. This suggests that while extension services play a role in disseminating information and best practices, their impact may be limited by accessibility, effectiveness, or farmer engagement. Studies by Ologbon *et al.* (2021) found that while extension services improve productivity, many farmers in rural areas face challenges in accessing them due to inadequate funding and limited personnel.

Table 4.4: Perceived factors influencing cassava yield

Factors	Frequency	Percentage
Age		
Yes	1	1.00
No	99	99.00
Sex		
Yes	1	1.00
No	99	99.00
Level of education-		
Yes	49	49.00
No	51	51.00
Farm size		
Yes	98	98.00
No	2	2.00
Household size		
Yes	8	8.00
No	92	92.00
Farming experience		
Yes	99	99.00
No	1	1.00
Extension services		
Yes	51	51.00
No	49	49.00

Source: Field survey, 2025

4.5 Perceived Changes in Climate

Table 5 presents the farmers' perceptions of climate changes in recent years, focusing on rainfall patterns, temperature fluctuations, and seasonal irregularities.

4.5.1 General Awareness of Climate Change

An overwhelming 99% of respondents reported noticing climate changes in recent years, while only 1% indicated no changes. This suggests that climate variability is a widely recognized phenomenon among cassava farmers in Uhunmwonde. These findings align with Nwafor *et al.* (2020), who reported that over 90% of Nigerian farmers acknowledge shifts in climatic patterns affecting their agricultural activities.

4.5.2 Perceived Changes in Rainfall

53% of farmers experienced excessive rainfall, while 47% did not. 50% observed that rainfall starts later than usual, and 48% noted that it stops earlier than expected. These findings indicate that rainfall patterns have become increasingly unpredictable, posing a challenge for rain-fed cassava production. Similar observations were made by Adepoju and Salami (2021), who found that irregular rainfall in South-South Nigeria has led to delayed planting and poor crop establishment.

4.5.3 Perceived Changes in Temperature

97% of respondents reported a noticeable temperature rise, while only 3% did not.

53% observed that temperatures are hotter than before, whereas 47% noted no significant changes. The high percentage of farmers perceiving temperature increases aligns with Ologbon *et al.* (2021), who noted that rising temperatures in Nigeria have negatively impacted crop productivity by increasing evaporation rates and altering soil moisture content.

4.5.4 Perceived Seasonal Irregularities

98% of farmers stated that seasonal patterns have become irregular, while only 2% disagreed.

This suggests that farmers are experiencing disruptions in traditional weather cycles, which affects cassava planting and harvesting. Studies by Tijani and Tijani (2021) confirm that erratic weather conditions lead to reduced agricultural productivity, particularly for smallholder farmers who rely on historical weather trends for planning.

Table 4.5: Perceived changes in climate

Variables	Freq	Percentage
Have you noticed changes in recent years?		
Yes	99	99.00
No	1	1.00
Excess Rainfall		
Yes	53	53.00
No	47	47.00
Drought		
Yes	53	53.00
No	47	47.00
Temperature rise		
Yes	97	97.00
No	3	3.00
Irregular season		
Yes	98	98.00
No	2	2.00
Changes observed in rainfall		
Rainfall starts later than usual	50	50.00
Rainfall stops earlier than usual	48	48.00
No noticeable change	2	2.00
Changes observed in temperature		
Hotter than before	53	53.00
No noticeable changes	47	47.00

Source: Computed field survey, 2025

4.6 Coping Strategies

The results of Table 6 showed that the coping strategies adopted by cassava farmers in response to climate variability in the study area. The data highlights the prevalence of specific practices aimed at mitigating the adverse effects of climate change on cassava production.

4.6.1 Crop Rotation

A significant 96% of farmers practice crop rotation, while only 4% do not. Crop rotation is a widely recognized strategy for maintaining soil fertility and preventing pest infestations, ultimately leading to improved cassava yield. This aligns with findings by Adepoju and Salami (2021), who reported that crop rotation enhances soil structure and reduces the risk of soil degradation in cassava-producing areas.

4.6.2 Use of Improved Seed Varieties

The results indicate that 54% of farmers use improved seed varieties, whereas 46% do not. This suggests that slightly more than half of the farmers are adopting climate-resilient cassava varieties, while a significant proportion still relies on traditional varieties. Studies by Nwafor *et al.* (2020) highlight that the use of improved seed varieties contributes to higher yields and better resistance to climatic stressors. However, adoption rates may be limited by access to certified planting materials and cost constraints.

4.6.3 Soil Conservation Techniques

A total of 54% of respondents apply soil conservation techniques, while 46% do not. This implies that soil conservation methods such as mulching, contour farming, and cover cropping are moderately utilized. Ologbon *et al.* (2021) found that farmers who actively engage in soil conservation experience more stable yields despite erratic rainfall patterns.

4.6.4 Crop Diversification

Nearly all farmers (98%) diversify their crop production, while only 2% do not. This suggests that most cassava farmers employ diversification as a risk-management strategy to spread production risks across multiple crops. Tijani and Tijani (2021) reported that crop diversification is one of the most effective adaptation measures for smallholder farmers facing climate uncertainties, as it reduces dependency on a single crop.

4.6.5 Perceived Impact of Climate Variability

An overwhelming 97% of respondents stated that climate variability has affected their farms, while only 3% disagreed. This confirms that nearly all farmers recognize climate variability as a challenge to cassava production. Similar findings were reported by Ogunleye *et al.* (2019), who noted that climate-related changes such as unpredictable rainfall and extreme temperatures have significantly impacted cassava farming in Nigeria.

Table 4.6: Coping strategies

Strategies	Freq	Perc
Crop rotation		
Yes	96	96.00
No	4	4.00
Improved seed varieties		
Yes	54	54.00
No	46	46.00
Soil conservation techniques		
Yes	54	54.00
No	46	46.00
Diversify crop production		
Yes	98	98.00
No	2	2.00
Has climate variability affected your farm		
Yes	97	97.00
No	3	3.00

Source: Field survey, 2025

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

This study examined the effects of climate variability on cassava production in Uhunmwonde LGA, focusing on yield comparison, factors influencing productivity, and farmers' adaptation strategies.

Cassava Yield: Farmers' average yield was lower than the national average, but the t-test showed no significant difference.

Factors Influencing Yield: Capital investment had a significant positive impact, while farm size, labor cost, and climate factors (rainfall, temperature) had no significant effects.

Coping Strategies: Majority of the farmers used crop diversification, improved cassava varieties, and soil conservation techniques to mitigate climate variability.

Climate Perception: Majority the of farmers acknowledged climate variability, noting unpredictable rainfall and rising temperatures as key challenges.

5.2 Conclusion

The study confirms that while cassava yields in Uhunmwonde are slightly lower than the national average, they are not significantly different, indicating that local farmers are adapting well to climate variability. Capital investment plays a crucial role in productivity, while climate factors appear to have minimal direct effects. Farmers rely on various adaptation strategies, suggesting that resilience to climate change is already being developed within the farming system.

5.3 Recommendations

1. **For Policy and Support Programs:**
   - Improve financial access: Provide low-interest agricultural loans and input subsidies to cassava farmers.
   - Strengthen extension services: Train farmers on climate-smart agriculture and efficient resource use.
2. **For Farmers:**
   - Adopt improved cassava varieties: Encourage the use of drought-tolerant, high-yield varieties.
   - Enhance soil management: Promote sustainable practices like mulching and composting.

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RESEARCH QUESTIONNAIRE
DEPARTMENT OF AGRICULTURAL ECONOMICS
AND EXTENSION SERVICES
FACULTY OF AGRICULTURE
UNIVERSITY OF BENIN, BENIN CITY, EDO STATE

Dear Respondent,

I am a final year student of the above Department, I am conducting research on "**EFFECT OF CLIMATE VARIABILITY ON CASSAVA PRODUCTION CAPACITY IN UHUNMWONDE LOCAL GOVERNMENT AREA OF EDO STATE, NIGERIA**". Your participation in this survey is highly valuable and will help us understand the effects of climate variability on cassava production. Your true and sincere response will be highly appreciated. Your responses will be kept confidential and used for research purposes only.

Thank you for your time and cooperation.

Yours faithfully,

Aboje Sunday ABAH
Researcher

Please tick (√) and fill gap(s) where appropriate

Section A: Socioeconomic Characteristics of Respondents

1. Gender: (a) ☐ Male (b) ☐ Female
2. Age: _____________(in years)
3. Marital Status:(a) ☐ Single (b) ☐ Married (c) ☐ Widowed (d) ☐ Divorced
4. Level of Education Completed:(a) ☐ Non-formal Education (b) ☐ Primary Education (c) ☐ Secondary Education (d) ☐ OND/NCE (e) ☐ HND/BSC (f) ☐ Others (please specify)________________________
5. Household Size: (Number of people in your home): __________________
6. Farm Size (in hectares): _________________________
7. Farming Experience (In Years): ________________________
8. Nature of farm ownership :(a) ☐ Sole proprietorship (b) ☐ Family (c) ☐ Cooperative
 (d) ☐ Community
9. Cropping pattern:(a) ☐ Sole cropping (b) ☐ Mixed Cropping (c) ☐ Crop Rotation
(d)☐ Continuous Cropping
10. Primary Source of Income:
☐ Farming ☐ Business ☐ Salary job ☐ Others (Specify) _________

11. Have you ever received a loan for cassava farming? ☐ Yes ☐ No
If Yes, from which source?
☐ Bank ☐ Cooperative ☐ Government scheme ☐ Family/Friends ☐ Others

Section B: Cassava Yield and Comparison with National Average

12. National Average Annual Cassava Yield (in kg): ___________________________
13. How many years have you been growing cassava? _________
14. What cassava variety do you cultivate? ☐ Local ☐ Improved ☐ Both
15. Average quantity of cassava harvested per season
☐ < 5 tons ☐ 5–10 tons ☐ 11–20 tons ☐ > 20 tons
16. Do you perceive your cassava yield to be increasing or decreasing over the years?
☐ Increasing ☐ Decreasing ☐ No change
17. What do you think affects your cassava yield the most?
☐ Climate change ☐ Pests/Diseases ☐ Poor soil fertility ☐ High input costs

Section C: Socioeconomic and Price Factors Influencing Net Revenue

18. Average Price per kg of Cassava Sold (in Naira): ____________________
19. How much do you spend on cassava farming per season? (₦) ____________
20. Monthly Income from Cassava Farming (in Naira): __________________
21. Do you use hired labour? ☐ Yes ☐ No
If Yes, how much do you pay per worker per day? (₦) _________
22. Do you use fertilizer? ☐ Yes ☐ No
If Yes, how many bags per farm? ☐ 1–2 ☐ 3–5 ☐ More than 5
How do you apply it? ☐ Broadcasting ☐ Spot application
23. Do you use herbicides? ☐ Yes ☐ No
If Yes, how many bottles per application? ☐ 1–2 ☐ 3–5 ☐ More than 5
How many times do you spray per season? ☐ 1 ☐ 2 ☐ 3 or more
24. Do you irrigate your farm? ☐ Yes ☐ No
25. What are your biggest production costs? (Tick all that apply)
☐ Fertilizer ☐ Herbicides ☐ labour ☐ Land rent ☐ Transportation
26.. Do you feel age influences your cassava yield? ☐ Yes ☐ No
27. Do you feel gender influences your cassava yield? ☐ Yes ☐ No
28. Do you feel level of education influence your cassava yield ☐ Yes ☐ No
29. Do you feel farm size influences your cassava yield? ☐ Yes ☐ No
30. Do you feel household size influences your cassava yield? ☐ Yes ☐ No
31. Do you feel farming experience influences your cassava yield? ☐ Yes ☐ No
32. Do you feel access to extension services influence your cassava yield? ☐ Yes ☐ No

33. Do you have access to agricultural extension services regarding climate-smart farming practices? ☐ Yes ☐ No
34. If yes, where do you access them from? ☐Radio ☐TV ☐Mobile app ☐Extension services
35. Do you have access to credits? ☐ Yes ☐ No
36. How do you get your stem cuttings ? ☐ Purchase ☐ Previously cultivated farm
37. What is the price of purchased stem cuttings? _________________

Section D: Perception of Climate Variability

38. Have you noticed changes in the climate in recent years? ☐ Yes ☐ No
39. Which climatic factor affects your cassava farm the most?
☐ Excess rainfall ☐ Drought ☐ Temperature rise ☐ Irregular seasons
40. How do you perceive the effect of climate variability on cassava production?: (a) ☐ Very severe (b) ☐ Severe (c) ☐ Moderately Severe (d) ☐ Least severe (e) ☐ not severe
41. What changes have you noticed in rainfall patterns?
☐ Rainfall starts later than usual
☐ Rainfall stops earlier than usual
☐ Excessive rainfall at unusual times
☐ No noticeable change
42. What changes have you noticed in temperature?
☐ Hotter than before
☐ Colder than before
☐ No noticeable change

Section E: **Adaptation Strategies for Climate Variability**

43. Which adaptation strategies have you implemented to address climate variability?
(a) ☐ Crop rotation (b) ☐ Improved seed varieties (c) ☐ Soil conservation techniques
(d) ☐ Diversified crop production (e) ☐ Others (please specify)
____
44. Has climate variability impacted your farming practices? ☐ Yes ☐ No
45. Do you receive information or training on climate adaptation practices? ☐ Yes ☐ No
46. If yes, from which sources do you receive support?
(a) ☐ Government extension services (b) ☐ Local NGOs (c) ☐ Farmers' associations
(e) ☐ Others (please specify)_________________________