*International Journal of Organic agricultural Research & Development*
*Volume 19 (2) (2024)*

# ADOPTION OF CLIMATE SMART AGRICULTURAL PRACTICES AMONG CASSAVA FARMERS IN IDO LOCAL GOVERNMENT AREA OF OYO STATE

***Taiwo, O. D., Adigun A.K., Adesanlu A.A., Ishie D.N. and Adewole A.O.**
Department of Agribusiness Management, Federal College of Animal Health and Production Technology, P.M.B. 5029, Ibadan, Oyo State
*Corresponding Author: domefranka@yahoo.com, GSM: +2348060601929

## ABSTRACT

Agriculture plays a pivotal role in Nigeria's economy, contributing over one-third of the nation's GDP and labor force. Among various crops, cassava is of particular importance as Nigeria is the largest producer globally. However, climate change poses significant threats to agricultural productivity due to erratic weather patterns, droughts, and declining rainfall. This study explores the adoption of Climate Smart Agriculture (CSA) practices by cassava farmers in Ido Local Government Area, Oyo State, to enhance resilience, productivity, and sustainability. The study's population comprised cassava farmers in Ido, using a two-stage sampling method selecting five out of ten political wards, then randomly choosing ten villages from these wards, with twelve registered cassava farmers from each village, totaling 120 farmers with 109 fully completed questionnaires returned. The objectives include analyzing the socio-economic characteristics of cassava farmers, assessing their awareness of CSA practices, and identifying factors influencing their adoption. The study found that farmers had a mean age of 49 years and 26 years of farming experience, with 63.3% being male. While most farmers were aware of CSA practices, including adjusting planting dates (97.2%), improved cassava varieties (100%), and application of green manure (99.1%), the adoption rate varied. The majority of farmers (60.6%) were classified as high adopters of CSA practices, followed by moderate (30.3%) and low (9.2%) adopters. Key factors influencing adoption included income, membership in farmers' associations, credit access, and farming experience. Increased income and access to credit positively influenced CSA adoption in low and moderate categories, but negatively impacted farmers in the high category. The study emphasizes the need for improved access to education, credit facilities, and agricultural extension services to support sustainable agricultural practices.

**Keywords:** Climate Smart Agricultural Practices, Cassava Farmers, Ordered Probit Regression, Adoption

## INTRODUCTION

Agriculture is vital to Nigeria's economy, providing jobs and constituting more than one-third of the nation's GDP and labour force (FAO, 2005; World Bank, 2003). The principal crops cultivated in Nigeria are beans, sesame, cashew, cassava, cocoa, groundnuts, kolanut, maize, melon, millet, palm oil, plantains, rice, rubber, sorghum, soybeans, and yams (Olomola, 2007). Due to erratic weather patterns, droughts, deserts, and increasing coastal and dropping continental interior rainfall, agriculture is one of the most susceptible economic sectors to climate change.

Nigeria is the largest producer of cassava globally and also the largest producing region in the world, producing approximately fifty million tonnes per year (Musa *et al.,* 2022), and by the year 2020, it was the world's second-largest crop, encompassing three million hectares which represented twenty percent of global cassava cultivation. Although cassava cultivation is anticipated to increase worldwide by 48-90% from 2011 to 2045. Cassava is a significant crop in Nigeria which is known for its growth potential, nutritional value for humans and animals, enrichment and fortification capabilities, toxicity, industrial applications, production economics, and genetic enhancement. Nigeria has been designated as the foremost global producer of cassava (Banditvong *et al*., 2024). Because cassava is the primary staple crop in Nigeria and some of its derivatives are exported commodities, it accounted for 21% of the global total in 2012. The value of cassava products has risen by 36% since 2005, when it was priced at $220.4 (Inegbedion *et al*., 2020).

Climate Smart Agriculture (CSA) was established by the United Nations Food and Agriculture Organization (FAO) in 2010 to augment production, bolster resilience, and mitigate greenhouse gas emissions while advancing national food security and developmental objectives. It involves the integration of enhancements in agricultural production and livelihood security in a sustainable manner, utilizing current resources in a manner that maximizes their productivity and minimizing risk is a frequent strategy for adapting to the changing environmental circumstances. This process may be referred to by several titles, with one of the newly used expressions being climate-smart agriculture practices (Autio *et al*., 2021). Climate-smart agriculture entails the amalgamation of productivity enhancement, climate change adaptation, and mitigation, aimed at influencing food security for current populations and future generations. Given that climate change is increasingly included into development plans, it may be argued that traditional agricultural technology should be replaced with more resilient climate technologies (Majhi *et al*., 2023). Outdated technologies are much more hazardous and vulnerable to environmental fluctuations, which may hinder rather than enhance food security and poverty alleviation, thus obstructing the achievement of the Millennium Development Goals (Owusu, 2020).

The primary difficulty confronting cassava cultivation in Nigeria is sub-optimal yield, which can be attributed to genetically inferior varieties, drought conditions, poor soil fertility, weed, insects and pests infestations among others. This study aimed to provide answers to various objectives which include to describe the socio-economic characteristics of the cassava farmers; identity the levels of awareness on climate smart agricultural practices; identify the types of climate smart agricultural practices adopted by cassava farmers and identify the factors influencing the usage of climate smart agricultural practices on cassava production in Ido Local Government Area of Oyo state.

## METHODOLOGY

**Study Area**

The study was conducted in Ido Local Government Area of Oyo State, Nigeria, which is located in the southern geopolitical zone and was one of three states created from the former western region in 1976. It encompasses of 33 Local Government Areas and 29 Local Council development areas covering an area of 986km² with a projected 2020 population of 174,826. The region is in the forest belt with temperatures between 25°C and 35°C, a wet season from April to October averaging 27°C, a dry season from November to March, and annual rainfall of about 1800mm. Ido LGA is highly endowed with fertile agricultural land suitable for farming activities, trading, artisanship, hunting, and livestock farming. It is predominantly inhabited by Yoruba-speaking people and migrant livestock farmers. The major crops grown include cassava, maize, beans, okro, cattle, sheep, goats, fish, and poultry.

**Instrument for data collection**

Primary data was used in collecting data for this study through a well-structured questionnaire and interview guide.

**Sampling Technique**

The study population comprised of cassava farmers in Ido LGA, which involves a multi-stage sampling procedure. The first stage involves random selection of five (5) out of ten (10) political wards followed by a random selection of ten (10) villages from these wards. In the third stage, twelve (12) registered cassava farmers from each village were selected randomly, totaling 120 farmers with 109 fully completed questionnaires returned.

**Data Analysis**

**Descriptive Statistics**

Descriptive statistics such as mean, standard deviation and percentages were used to assess the socio economic characteristics of cassava farmers, their level of awareness about climate smart agricultural practices, types of climate smart agricultural practices adopted and the adoption level of climate smart agricultural practices.

**Ordered Probit Regression Model**

Ordered probit regression model was used to analyze the factors influencing the adoption index of cassava farmer. The empirical model for the Ordered Probit Regression Analysiswas specified implicitly as follows:

$$Y_I^* = X_I^* \beta + u_i$$

Where,

Y = level of adoption of climate smart agricultural practices (1= low level, 2 = moderate level, 3 = high level)

$X_1$ = Sex (Female = 0, Male = 1)

$X_2$ =Household size (No. of persons)

$X_3$ = Membership of an association(Yes=1,No= 0)

$X_4$ = Farm experience(years)
$X_5$ = Access to extension agent(Yes=1,No= 0)
$X_6$ =Credit access(Yes=1,No= 0)
$X_7$=Access to health care(Yes=1.No= 0)
$X_8$ =Quantity of cassava harvested(Kilogram)
$X_9$ =Education (years)
$X_{10}$= Farm size (Hectare)
$X_{11}$ = Income (Naira)
$\mu$ = Error term

## RESULTS AND DISCUSSION

In table 1, the findings of the study indicated the mean age of 49 years old, demonstrating active involvement of older populations in farming. Agriculture is the primary economic activity in rural communities, contributing to rural development and livelihoods. Gender disparity is apparent, where 63.3% of farmers were male and 36.7% were female, 37.6% of respondents have completed secondary education. The mean household size was 5 indicating a larger number of family labour being used in the farming activities. Furthermore, the respondents have a mean year of farming experience of about 26.26 years, indicating a greater uptake of new technologies. Despite this, most farmers do not have access to credit facilities and agricultural extension services, both of which are essential for sustainable agricultural productivity this result was supported by Oladiran *et al*., (2021). However, 53.2% of cassava farmers were members of agricultural associations, allowing them to benefit from agricultural development opportunities and support networks provided by government and non-governmental organizations. A majority of respondents do not have access to healthcare, which is detrimental to individual and community health and overall quality of life. Most farmers acquire cassava from friends and let it mature for 12 months. Additionally, a large percentage of farmers rent land and sell their produce directly to consumers. The study emphasizes the importance of education and healthcare access for sustainable agricultural practices, this result is also supported by Otekunrin *et al*., (2021).

### Respondents level of awareness on Climate Smart Agricultural Practice

The results in Table 2 showed the level of awareness of the respondents about climate-smart agricultural practices. Most of them are aware about adjusting planting dates (97.2%), planting improved cassava varieties (100%), application of green manure (99.1%), using irrigation facilities (97.2%), mulching techniques (72.7%), mixed/ inter cropping (76.1%), agro-forestry practices (56.9%), planting cover crops (90.8%), crop rotation (74.3%), application of animal manure (56.0%) and adopting minimal tillage (85.3%). Basically, cassava farmers in the study area know a lot about climate-smart agricultural practices, which is essential for adapting to climate change and reducing its negative effects on agriculture. This knowledge helps build a strong, resilient agricultural system that can handle the challenges posed by climate change and other factors affecting agricultural production.

### Types of Climate Smart Agricultural Practices the Respondents adopted

The results in Table 3a show the willingness of respondents to adopt Climate Smart Agricultural Practices (CSAP). The result revealed that 60.6% were high adopters, 30.3% were moderate adopters while 9.2% were low adopters. This suggests that cassava farmers were able to adapt their schedules to fit their farming operations, which aligns with findings of Ayanlade (2009) stating that smallholder farmers plant crops based on steady rainfall, rather than at the beginning of the farming season.

The results in Table 3b revealed the types of climate-smart agricultural practices that farmers adopted in the study area. It was found that majority (98.2%) of respondents were adjusting their planting dates. Additionally, (99.1%) have adopted improved cassava varieties, also 98.2% of the farmers adopted green fertilizer. However, all respondents have adopted mulching techniques, while 85.3% use inter-cropping, some (35.8%) use agro-forestry practices. Others have adopted planting cover crops (72.5%), crop rotation (89%), and using animal manure (57.8%). This result is in line with Ogunjinmi *et al*., (2023) that African yam bean (green manure was highly utilized as natural fertilizers by 59.2% of the rural household. This implies that rural household utilized African yam bean as natural fertilizers which helps to fix nitrogen in the soil.

Most of the respondents demonstrated good and adequate knowledge regarding the adoption of these practices. It's important for farmers to have this knowledge as it helps with climate change adaptation. This allows for the development of a more resilient agricultural system to mitigate the adverse effects of climate change and other challenges.

**Ordered Probit Regression Model Analysis Showing the Factors Influencing Adoption Level**

Result in Table 4 shows the ordered probit regression model that was used to determine the factors that influences the level of adoption of climate change adaptation strategies among cassava farmers in the study area. From the result, the significant variables were income, farmers' association, farm experience and credit access.

In terms of increase in income, farmers in the low category have a 1.1% lower probability of adopting climate change adaptation strategies. For every unit increase in income, farmers in the moderate category have a 2.3% lower probability of adopting climate change adaptation strategies wile for every unit increase in income, farmers in the high category have a 3.4% higher probability of adopting climate change adaptation strategies. This implied that farmers in low and moderate categories may not have the financial resources to invest in adaptation strategies, even with higher income.

The marginal coefficient of -0.141 indicates that farmers who belong to an association in the low category have a 14.1% higher probability of adopting climate change adaptation strategies compared to those who do not belong to an association, holding all other variables constant. Belonging to an association in the moderate category is associated with a 23.7% increase in the likelihood of adopting climate change adaptation strategies. The marginal coefficient of 0.379 indicates that farmers who belong to an association in the high category have a 37.9% higher probability of adopting climate change adaptation strategies compared to those who do not belong to an association. A 15.7% increase in credit access is associated with a higher likelihood of adopting climate smart agricultural practices among farmers in the low category while a 26.0% increase in credit access is associated with a higher likelihood of adopting climate change adaptation strategies among farmers in the moderate category and a 41.7% decrease in credit access is associated with a lower likelihood of adopting climate change adaptation strategies among farmers in the high category. Credit access had a positive effect on climate change adaptation strategies for farmers in low and moderate categories. However, for farmers in the high category, credit access had negative effect, which implied that they may not rely on credit for adaptation strategies.

In terms of increase in year of experience, farmers in the low category have a 0.1% lower probability of adopting climate change adaptation strategies. For every unit increase in year of experience, farmers in the moderate category had a 1.7% lower probability of adopting climate change adaptation strategies. For every unit increase in year of experience, farmers in the high category have a 2.4% higher probability of adopting climate change adaptation strategies. This implied that farmers in low and moderate categories may be less open to new ideas and technologies.

## CONCLUSIONS AND RECOMMENDATIONS

The study revealed that cassava farming remains a crucial aspect of Nigeria's agricultural sector, significantly contributing to rural livelihoods and food security. However, climate change poses serious challenges to its productivity. Climate Smart Agriculture (CSA) practices have shown promise in mitigating these impacts and improving the resilience of cassava farmers. The research demonstrated that a majority of farmers in Ido Local Government Area are aware of and adopt CSA practices, although the level of adoption varies based on socio-economic factors such as income, farming experience, and access to credit and farmer associations. Farmers in the low and moderate adoption categories face challenges in fully implementing CSA due to limited financial resources, credit access, and extension services. The study highlights the importance of improving these areas to foster greater adoption of climate-smart practices and ensure the sustainability of cassava farming in the face of climate change.

It was recommended that Governments and financial institutions should develop affordable credit facilities tailored to the needs of smallholder farmers. This will enable them to invest in climate-smart agricultural technologies, particularly for those in the low and moderate adoption categories, Extension programs should be expanded and improved to provide farmers with more technical knowledge and practical skills in adopting CSA practices. Training sessions on CSA strategies, such as improved crop varieties, irrigation techniques, and soil fertility management, should be made accessible to farmers in remote areas.

**REFERENCES**

Autio, A., Johansson, T., Motaroki, L., Minoia, P., & Pellikka, P. (2021). Constraints for Adopting Climate-Smart Agricultural Practices among Smallholder Farmers in Southeast Kenya. Agricultural Systems, 194, 103284. sciencedirect.com.

Ayanlade, A. (2009). Seasonal Rainfall Variability in Guinea Savannah Part of Nigeria: A GIS Approach. *International Journal of Climate Change Strategies and Management*. Vol: 1(3): pp 282-296.

Banditvong, C., Varongchayakul, S., Laosiripojana, N., &Songkasiri, W. (2024). Production of Micro and Nano Crystalline Cellulose from Waste Cassava Pulp and Cassava Pulp Treated from Biogas System. researchsquare.com

Food and Agriculture Organization, FAO (2005). Impact of climate change, pests and diseases on food security and poverty reduction. Special event background document for the 31st Session of the Committee on World Food Security, Rome.

FAO, (2010). “Climate-Smart” Agriculture. Policies, practices and financing for food security, adaptation and mitigation. Rome: Food and Agriculture Organization of the United Nations (FAO).

Musa, S. M., Samuel, E. B., Sani, M., & Mari, E. (2022). Cassava production, processing and utilization in Nigeria: A review. *African Scholar Journal of Biotechnology and Agricultural Research* (JBAR-1), 6(1), 43-64. africanscholarpublications.com.

Oladiran, S. S., Adepoju, O. A., Sheleru, K. M., Adediji, D. B., & Agude, T., (2021). Adoption of Improved Maize Production Practices by Farmers in Akinyele LGA of Oyo State, Nigeria. *The International Journal of Agriculture, Management and Technology*, Vol 5, No. 1, 2021 ijamt.com.ng.

Ogunjinmi, K. O., Adetarami, O., Oyebamiji, B. A., Adeosun, K. G., Adebayo, T. D., &Obasa, P. (2023). Climate Change Adaptation Needs of Arable Crop Farmers in Ido Local Government Area, Oyo State, Nigeria. *Nigeria Agricultural Journal*, 54(2), 171-177. ajol.info.

Olomola A.S, (2007). strategies for managing the opportunities and challenges of the current Agricultural commodity Booms in SSA”. Economics Research consortium (AERC), Nairobi, Kenya.

Otekunrin, O. A., Otekunrin, O. A., Sawicka, B., &Pszczółkowski, P. (2021). Assessing food insecurity and its drivers among smallholder farming households in rural Oyo State, Nigeria: the HFIAS approach. Agriculture, 11(12), 1189. mdpi.com.

Owusu, F. (2020). An Analysis Of Perceptions Amongst Farmers On The Adoption Of Gm Technology In Paarl, Western Cape-South Africa.. core.ac.uk.

World Bank (2003). Women in agriculture in “Nigeria: Sharing experience – examples of participatory approaches. The World Bank Group. In” the World Bank Participating Source Book, Washington D.C.

**Table 1: Socio-economic Characteristics of the Respondents (n=109)**

| Variables | Sub-groups | Frequency | Percentage | Mean |
|---|---|---|---|---|
| **Age (Yrs)** | < 30 | 4 | 3.7 | |
| | 31-40 | 11 | 10.1 | 49.86 |
| | 41-50 | 35 | 32.1 | |
| | > 51 | 59 | 54.1 | |
| **Sex** | Female | 40 | 36 | |
| | Male | 69 | 63.3 | |
| **Religion** | Muslim | 40 | 36.7 | |
| | Christian | 69 | 63.3 | |
| **Marital status** | Single | 9 | 8.3 | |
| | Married | 89 | 81.7 | |
| | Divorced | 11 | 10.1 | |
| **Educational status** | No formal | 11 | 10.1 | |
| | Primary | 36 | 33.0 | |
| | Secondary | 41 | 37.6 | |
| | Tertiary | 19 | 17.4 | |
| **Household size** | 3-4 | 15 | 13.8 | |
| | 5-6 | 18 | 16.5 | 5 |
| | Above 7 | 76 | 69.7 | |
| **Farm experience** | 10-20 | 41 | 37.6 | |
| | 21-30 | 39 | 35.8 | 26.26 |
| | 31-40 | 13 | 11.9 | |
| | 41-50 | 16 | 14.7 | |
| **Membership** | No | 48 | 44.0 | |
| | Yes | 58 | 53.2 | |
| **Access to extension agent** | No | 62 | 56.9 | |
| | Yes | 44 | 40.4 | |
| **Access to credit** | No | 59 | 54.1 | |
| | Yes | 47 | 43.1 | |
| **Access to health care** | No | 65 | 59.6 | |
| | Yes | 41 | 37.6 | |
| **Sources of cassava** | Friends | 64 | 58.7 | |
| | Association | 36 | 33.0 | |
| | Research institute | 7 | 6.4 | |
| **Maturity** | 10 | 1 | 0.9 | |
| | 11 | 19 | 17.4 | |
| | 12 | 89 | 81.7 | |
| **Mode of farm ownership** | Purchase | 11 | 10.1 | |
| | Rented | 79 | 72.5 | |

**Source: Field survey, 2024**

**Table 2: Respondent's level of awareness on Climate Smart Agricultural Practices**

| Level of awareness | Aware | Not aware |
|---|---|---|
| Adjustment of planting date | 106 (97.2) | 3 (2.8) |
| Improved cassava varieties | 109 (100) | - |
| Green manure | 108 (99.1) | 1 (0.9) |
| Irrigation facilities | 106 (97.2) | 3 (2.8) |
| Mulching techniques | 101 (92.7) | 8 (7.3) |
| Inter cropping | 83 (76.1) | 26 (23.9) |
| Agroforestry practices | 62 (56.9) | 47 (43.1) |
| Planting of cover crops | 99 (90.8) | 10 (9.2) |
| Crop rotation | 81 (74.3) | 28 (25.7) |
| Animal manure | 61 (56.0) | 48 (44.0) |
| Zero/Minimum tillage | 93 (85.3) | 16 (14.7) |

**Source: Field survey, 2024**

**Table 3a: Distribution of the Respondents Adoption Level of Climate Smart Agricultural Practices**

| Adoption level | Frequency | Percentage |
|---|---|---|
| High | 66 | 60.6 |
| Moderate | 33 | 30.3 |
| Low | 10 | 9.2 |
| Total | 109 | 100 |

**Source: Field survey, 2024**

**Table 3b: Types of Climate Smart Agricultural Practices the Respondents Adopted**

| CSAP Adoption | Yes | No |
|---|---|---|
| **Adjustment of planting date** | 107 (98.2) | 2 (1.8) |
| **Improved cassava varieties** | 108 (99.1) | 1 (0.9) |
| **Green manure** | 107 (98.2) | 2 (1.8) |
| **Mulching** | 109 (100) | - |
| **Inter cropping** | 93 (85.3) | 16 (14.7) |
| **Agroforestry practices** | 39 (35.8) | 70 (64.2) |
| **Planting of cover crops** | 79 (72.5) | 30 (27.5) |
| **Crop rotation** | 97 (89.0) | 12 (11.0) |
| **Animal manure** | 63 (57.8) | 46 (42.2) |
| **Zero/Minimum tillage** | 92 (84.4) | 17 (15.6) |

**Source: Field survey, 2024**

**Table 4: Factors Influencing Level of Adoption of Climate Change Adaptation Strategies**

| Variables | Coefficients | Marginal effects (dy /dx) | | |
|---|---|---|---|---|
| | | Low | Moderate | High |
| Sex | -0.358(0.267) | 0.043 | 0.092 | -0.136 |
| Income | 0.091(0.036)** | -0.011** | -0.023** | 0.034** |
| Years of Education | -0.006(0.031) | 0.001 | 0.001 | -0.002 |
| Household size | 0.095(0.154) | -0.011 | -0.024 | 0.036 |
| Years of experience | 0.064(0.024)*** | -0.008** | -0.017** | 0.024*** |
| Membership of association | 1.024(0.401)** | 0.141** | 0.237*** | 0.379*** |
| Access to extension agents | -0.569(0.696) | 0.073 | 0.141 | 0.215 |
| Access to credit | -1.143(0.471)** | 0.157** | 0.260*** | -0.417*** |
| Access to health facilities | 0.113(0.627) | -0.013 | -0.029 | 0.042 |
| Farm size | 0.057(0.102) | -0.007 | 0.015 | 0.021 |
| Quantity harvested | -0.762(0.107) | 0.009 | 0.019 | -0.029 |
| Cut 1 | -4.731(1.455) | | | |
| Cut2 | -3.513(1.439) | | | |
| No of observation | 109 | | | |
| LR chi2(11) | 22.91 | | | |
| Prob > chi2 | 0.0182 | | | |
| Pseudo R2 | 0.1188 | | | |

Note: Standard errors in parenthesis
*, **, *** represents significance level at 10%, 5%, and 1%, respectively