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Effect of climate-smart agricultural practices on food security of rural farming households in southwest, Nigeria

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ABSTRACT

Aim: The aim of this study was to identify various CSA practises and to determine the effect of CSA practices on food security status of rural farming households in Nigeria.

Materials and Methods: Multi-stage sampling technique was used to select 480 rural farming households across three selected states in Southwest, Nigeria. The data were analyzed using descriptive and inferential statistics - Foster-Greer-Thorbecke (FGT) and Logit regression analysis.

Results: The results revealed that the majority (76.0%) of the respondents were married, while mean age, household size and farm size were 47.1 years, 5.31 persons and 3.77 hectares respectively and 72.0% with income from farming less than $250. Crop diversification was the most practised CSA in the study area. Also, 57.95% of the farming households were food secured, while 42.05% were food insecure. The depth food insecure and severe food insecurity among the sampled farming households were 0.1913 and 0.0711 respectively. The logistic regression result showed that the food security status of rural farming households was significantly affected by gender, farm size, contact with extension agents and CSA practice.

Conclusion: It was concluded that the food security status of rural farming households in Nigeria was indeed influenced by CSA practised in crop farming. The adoption of CSA practices should be promoted and encouraged that will ensure agricultural sustainability in agrarian communities by mitigating the effect of climate change.

Keywords: Agriculture, climate Smart, crop diversification, food security, rural farming households.

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Introduction

Food provision for households is a necessity, with approximately 820 million individuals globally being faced with the challenge of hunger, while over two-thirds of the world's population lacking essential nutrients, thus influencing their diet, well-being and life expectancy (Food and Agricultural Organization of the United Nations (FAO, 2019). Climate change is one of the environmental problems facing mankind. The implication of climate change cuts across various sectors, ranging from health to agriculture. Climate change has significantly affected global agriculture in the 21st century (Akanbi *et al.*, 2021). The effects of climate change on agricultural production and food security are expected to intensify over time and vary across countries and regions (FAO, 2019).

Despite of its high contribution to the overall economy, this sector has been seriously facing challenges of many factors of which climate-related disasters like drought and floods are the major ones. Climate variability and change adversely affect agricultural sector and the situation is expected to worsen in the future (Brosch, 2021). There is a growing concern that climate change will seriously affect the ability to meet the food demands of about 10 billion world population come 2050, which is a significant reason why experts are promoting climate-smart agriculture (Akano *et al.*, 2022). Climate-smart agriculture (CSA) integrates socioeconomic and ecological components that ensure current food production activities do not affect the ability to produce food in the future. As it stands, conventional agricultural practices, which involve growing readily available low-yielding varieties with excessive nitrogen fertilizer application, are no longer sustainable due to adding to the release of greenhouse gases (GHGs) (FAO, 2019).

The adoption of CSA among farmers in developing countries especially in Nigeria is still low despite the numerous effort tailored towards the sensitization of farmers about its importance in mitigating against climate change (FAO, 2019). Akanbi *et al.* (2021) revealed that there are several factors contributing to low level of adoption of CSA in SSA ranging from technical know-how, poor awareness, cost, culture, and traditional beliefs, and poor infrastructures, financing, unsustainable government policy, and other socioeconomic constraints such as education level and years of farming experience. Amare *et al.* (2018), pin pointed that there is dire need of farmers to prepare towards climate change impacts by embracing adaptation and risk mitigation measures such as climate-smart agriculture so as to achieve food security in households level and globally. This article seeks to contribute to the body of knowledge on how to enhance food security in rural farming households through climate smart agricultural practices. The study aims to identify various CSA practises and to determine the effect of CSA practices on food security status using Nigeria as the case study.

Materials and Methods

This study was carried out in the rural Southwest, Nigeria which consists of six states, namely: Ekiti, Osun, Ogun, Oyo, Ondo, and Lagos. The area is bounded in the East by Delta State, the Republic of Benin in the West, Kwara and Kogi State in the North and by the Atlantic Ocean in the south. The major occupation in the geopolitical zone is farming, in which maize, cassava, yam, oil palm, cocoa and timber are equally produced comercially. Most rural families in the zone survive on subsistence farming, with supplementary income from other employment such as trading, hunting, food gathering and handcrfat. This resulted in the rural households dropping into a more severely poor category, resulting in the majority having to depend on savings and help from relatives.

Sampling techniques and data analysis

Primary data were used for this study and were collected through the use of a structured questionnaire. The sampling population consit of rural farming households majorly practice subsistence farming. A multi-stage sampling procedure was used to select 480 rural farming households across six states that made up the Southwestern, Nigeria. First stage involved random selection of 50% of the states (Oyo, Ekiti and Ogun) that made up of Southwestern geopolitical zone. The second stage involved selecting two Agricultural Development Programme (ADP) Zones from each state, making six zones. The third stage involved randomly selecting two blocks from each of the six ADP zones, making 12 blocks. Fourth stage involved randomly selecting four cells from each of the 12 blocks, making 48 cells. Last stage, involved randomly selecting 10 households from each of the 48 cells, which totaled 480 rural farming households. The data collected were analyzed using descriptive statistics (means and frequencies). Logit regression model was used to determine the effect of CSA practices on food security status of the respondents, while the Foster–Greer–Thorbecke (FGT) Index was used to classify the farming households into food secure and insecure.

Results and Discussion

The socio-economic characteristics of the respondents, with more than two-thirds of the households being male-headed (81.0%), with their mean age estimate at 47 years, thus revealing that they were expected to be productive with the available resources (Table 1). This was in line with Akano *et al*., (2021), who advocated the mean age of respondents in rural farming households of Nigeria was between the ages of 45 - 50 years. About 76.00% of the respondents were married, 78.00% had farming as their main source of livelihood activities with mean household size and farm size of 5 persons and 3.77 hectares respectively. Majority (72.00 percent) of the rural farming households earned less than $250.00 while about two-thirds (81.0 percent) of them had contact with extension agents. Extension agent was very important in information dissemination and adoption of new technology (Akter and Ahmed, 2021). The result of the climate smart agricultural practices (CSA) used by the respondents revealed that crop diversification was the form of CSAP mostly used in the study area. About 3.13% of the respondents were low users while 61.25% and 15.63% of the respondents are medium and high users respectively (Fig. 2). Amare *et al*., (2018) also corroborated CSAP in rural areas that were being silent and the importance were not well pronounced which could be the reason for its moderate usage in the study area.

Table 1: Summary of the socioeconomic characteristics of the respondents (n = 480) $1 = ₦720

Variable	Mean	SD
Gender of respondent (1 = male, female = 0)	0.81	0.193
Age group (1 = adult; 0 = youth)	47.1	0.201
Education level of respondent (1 = formal; 0 = Non formal)	0.62	0.117
Household size (number)	5.31	0.410
Marital Status (1 = Married; 0 = Otherwise)	0.76	0.291
Farm size (hectares)	3.77	1.321
Farming experience (years)	8.23	1.092
Contact with extension agent (1 = yes)	0.81	0.018
Main source of income: (1 = Farming, 0 = Others)	0.78	0.512
Income from farming: <250 USD	0.72	0.221
251 - 500 USD	0.20	0.012
> 500 USD	0.08	0.162

Table 2: Climate Smart Agricultural Practices (CSAP) and Degree of Usage

CSAP	WMS	SD
Crop diversification	4.723	1.004
Crop rotation	4.281	0.961
Mulching	2.104	0.452
Agroforestry	1.982	0.142
Use of Organic manure	3.441	0.811
Use of Fadama land	2.981	0.051
Planting crops with early maturity	3.831	1.031
Planting drought-tolerant crop varieties	4.016	1.441
Planting cover crop	1.052	1.113
Intercropping	4.101	0.742
Irrigation	1.961	0.022

WMS = Weighted Mean Score SD = Standard Deviation

Food security status of the respondents

Following Omotayo (2016), food insecurity parameters used were P_0 (food insecurity incidence (headcount)), P_1 (depth food insecurity) and P_2 (severity food insecurity). Food insecurity (head count), represents the proportion of household below the food security line. The results showed that the head count ratio or incidence of food insecurity within the households was 0.4205, indicating that 42.05% of the respondents were food insecure (unable to meet the daily recommended food security threshold) while 57.95% were food secure (Table 3). To identify the extent to which the food insecure households are below the recommended food security threshold, the food insecurity gap was calculated. This gap illustrates the various categories of the food insecurity situation experienced by the farming households in the study area.

The P_1 (depth food insecure) among the sampled farming households was 0.1913. This implies that if resources could be mobilized to meet 19.13% of caloric requirement of every food insecure households, theoretically, food insecurity can be eliminated. The value P_2 (severe food insecure) of the farming households was 0.0711, indicating that the food insecurity severity of the respondents was 7.11%. This showed that an average core food insecure household would require about 7.11% of the food insecurity line to the households' food budget in order move out of their severe food insecurity status. It could be inferred from the study that there is existence of food insecurity among the rural households in the study area. This was in conformity with Omotayo (2016) who reported that majority of rural farming households in Nigeria were food insecure.

Table 3: Food insecurity indices among the farming households

Food Insecurity Status	Value
Incidence of Food Insecurity (P_0)	0.4205
Depth food insecure (P_1)	0.1913
Severe food insecure (P_2)	0.0711

Maximum likelihood estimate of Logit regression of the effect of CSA practices on food security status

The result of the logit regression analysis showing the effects of selected socio-economic characteristics of the respondents and CSA practices on the food security status of the respondents (Table 5). The statistically significant variables affecting the food security status of the farming households were gender of household head ($p<0.1$), farm size ($p<0.01$), contact with extension agent ($p<0.05$), main occupation ($p<0.05$) and CSA practices ($p<0.01$). The gender of household's head was positive (0.1045) and significant ($p<0.1$), implying that a male-headed household had a higher probability of being food secure compared to their female counterparts, and might be due to more males have higher income generating activities. The result was butressed by Rahman *et al.*, (2021) who reported that there are more food secure male-headed households than female-headed in Nigeria. In addition, the coefficient of farm size was positve (1.3011) and significant ($p<0.01$).

Table 4: Logit regression result of the effect of climate smart agricultural practices on food security

Variables	Coefficient	Robust Standard Error	Z	Marginal effect
Constant	-0.1218***	0.1173	-2.4145	-0.0152
Gender	0.1045*	0.0891	1.8871	0.0229
Formal Education	0.1167**	0.0316	1.9409	0.0231
Household size	-0.0021	0.2184	-0.9618	-0.1209
Farm size	1.3011***	0.7101	2.3314	0.0321
Farming experience	-1.0019	0.5331	-0.9928	-0.0318
Farm income	0.0031	0.0346	1.0201	0.0313
Contact with Extension agent	1.0413**	0.1942	1.9903	0.0122
Main occupation	0.1043	0.2813	1.1193	0.0218
CSA Practice	2.0017***	0.5012	2.6711	0.1033
Likelihood =	-157.021			
Pseudo R^2	0.6275			
Chi Square	35.42***			
Number of observation	480			

Note: ***, **, and * represent 1%, 5%, and 10% significance level, respectively

It showed that the larger the farm size of a household the more the likelihood of being food secure. The coefficient of the education status of the household's head was positive (0.1167) and significant ($p<0.05$), which implies that educational level had a higher probability of leading to a food secure status. Education is expected to increase the capacity of farmers to obtain, process and utilize information relevant to the adoption and management of agricultural practices (Onyeneke *et al*., 2018). The coefficient of access to extension service and training was positive (1.0413) and significant ($p<0.05$), implying that an increase in access to extension service increased the likelihood of being food secure.

Furthermore, coefficient of CSA practices was positive (2.0017) and significant ($p<0.05$), imdicating that the more CSA practice, the higher probability of being food secure in the study area. The results imply that CSA adaptation would brighten the chances of farming households in the study area to be food secure.This results agrees with McClement (2019) on study of CSA practices and food security in smallholder production systems in SSA, which reveal that farmers who adopted CSA practices were at a better level of being food secure than non-adopters. The Adjusted R^2 of 0.6275 implies that the explanatory variables explain about 62.75 % of the variations in the logistics regression model of the effect of CSA practices on food security.

Conclusions

It was concluded that use of climate smart agricultural practices improved the food security status of farming households, with 57.5% of them being food secured and 42.5% being food insucre. Furthermore, crop diversification, crop rotation, planting of drought/heat tolerant crops, intercropping and using organic manure were among the highly accepted CSA practices by the sampled farming households in the study area. The results revealed that mainstreaming CSA into food crop production would impact the livelihood and food security status of small-scale farming households in the study area.

Based on the findings, it is recommended to promote and encourage the adoption of CSAP that would ensure agricultural sustainability in agrarian communities through mitigating the effect of climate change.

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