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ASSESSMENT OF ADOPTION OF CLIMATE SMART AGRICULTURAL PRACTICES AMONG CROP FARMERS IN BENUE STATE, NIGERIA

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Abstract

This study assessed adoption of climate smart agricultural practices among crop farmers in Benue State, Nigeria. All crop farmers in Benue State formed the population of the study, of which 219 respondents were selected using purposive and simple random sampling techniques. Primary data were used for the study, collected using a structured questionnaire. Data collected were analysed using both descriptive and inferential statistics. The findings showed that, majority (54.34%) of the respondents were aged between 51-60 years. Female respondents were 55.25% of the sample. Majority (82.19%) of the respondents were married and 88.6% had formal education. Many of the respondents (47.03%) had farm sizes below 3 hectares and 69.49% of them had annual income of between N500,001- N750,000. Findings on the level of adoption of Climate Smart Agricultural Practices in Benue State revealed that, crop rotation (= 2.72), intercropping with legumes (= 2.69), agroforestry (2.43), minimum tillage (2.39), conservation agriculture (=2.29), contour farming (=2.27), use of safety nets (=2.25), terracing (=2.18), irrigation (=2.15) and integrated nutrient management (=2.16) were adopted. It was concluded that, rural farmers in the study area have adopted climate-smart agricultural practices in Benue State. It is recommended that, rural farmers should strive to adopt climate Smart Agricultural Practices that are not available within their locality, but useful in agricultural activities.
Keywords: Assessment, Adoption, climate smart, Agricultural, Practices

1.0 Introduction

Agriculture is the main source of food and employer of labour, employing about 60-70 percent of the population in Nigeria and depends greatly on climatic variations (Adebayo, 2018). Climate change affects food and water resources that are critical for agricultural activities, which is a major source of livelihood of the rural poor. Disruptions of existing food and water systems will have devastating implications for development and livelihood. Consequently, the need to achieve ways of mitigating adverse effects of

climate change through climate smart agricultural practices (Adebayo, 2018).

Climate Smart Agricultural practices (CSAPs) are integrated approaches towards achieving food security in the face of climate change, while also mitigating climate change and contribute to other development goals (Food and Agriculture Organization (FAO) 2013). CSAPs are techniques used to improve the scientific rule and investment setting to attain sustainable agricultural progress to ensure food availability under climate change (FAO, 2013). Large variety of climate-smart agricultural practices have been developed all over the world, especially at the community level. Farmers elsewhere have adopted climate smart agricultural practices, which usually include farm-based sustainable agricultural land management practices such as conservation tillage, agroforestry, residue management, soil management, water management, livestock and grassland management and use of other climate smart agricultural practices such as early warning systems and crop insurances (FAO, 2013).

Substantial adoption level of climate smart agricultural practices could improve food availability, while reducing impacts of climate change (Tesfaye et al., 2017). Households who adopted and maintained CSA practices between 2020 and 2022 increased farm level production by 22 percent over non-adopters as a result of reduced climate-related risks (Asrat and Simane, 2022). Adoption of CSA practices recorded improved crop and animal production, increased resilience/adaptation to climate change, and offered mitigation benefits in kenya (Kimaro et al., 2019).

Regardless of Benue State being categorized as an agrarian area with high humidity, it is already facing challenges associated with climate change. Wambugu et al.

(2014), asserted that the productivity level and sustainability in crop and livestock production in the future will be threatened with predicted possibility of inconsistence and shortage in rainfall, degraded soils, incidences of pests and diseases outbreak. Rural farmers rely entirely on rainfall for cultivation, this requires an instant move to adoption of climate smart agricultural practices. According to Olorunfemi et al. 2014, Some rural farmers have already incorporated CSAP, however the adoption level still remains low, which may be due to limited information and lack of awareness of CSAP.

Several studies conducted in the area of climate smart agriculture by various scholars such as Amin, Mubeen, Hammad, and Jatoi (2015) focused on Climate Smart Agriculture for sustainable food security. Elsewhere, McCarthy, Lipper and Branca (2011) focused on the role of institutions for CSA improvement. Fawole and Aderinoye-Abdulwahab (2021) assessed farmers' adoption of climate smart practices for increased productivity in Nigeria; Joyce (2019) assessed the effects of climate smart agricultural awareness on food security among small-holder farmers in Kaptumo-Kaboi ward, Nandi county, however there is hardly any study that analyzed the adoption level of climate smart agricultural practices among rural farmers in Benue State. From the foregoing, little indepth study has been conducted on the adoption level of climate smart agricultural practices among crop farmers in Benue State. It is against this background that this study was carried out.

2.0 Objectives of the study

The broad objective of the study was to assess adoption of climate smart agricultural practices among crop farmers in Benue State, Nigeria. The specific objectives of this

study were to :

i. describe the socio-economic characteristics of rural farmers in the study area.
ii. determine adoption level of climate smart agricultural practices among rural farmers in the three agricultural zones in the study area.

Hypothesis of the study

Socio-economic characteristics of the respondents have no significant effect on adoption level of climate smart agricultural practices in the study area.

3.0 Methodology

The study was conducted in Benue State, Nigeria. The State lies between longitudes 6'35' E and 8'10' E of the Greenwich Meridian and latitudes 6°30' N and 8'10' N of the equator at an elevation of 97m above sea level in Southern Guinea Savannah agro ecological zone. The State has 23 Local Government Areas (LGAs), It covers a landmass of 3,251 8 Km with an estimated population of 6,286, 170 people (NPC, 2022). It lies in the North-Central region of Nigeria and share boundaries with five other states; Nasarawa to the North, Taraba to the East, Cross-River to the south, Enugu to the south-east and Kogi to the west. The State also shares a common boundary with the Republic of Cameroon in the South-east (Benue State Agricultural and Rural Development Authority (BNARDA, 2010).

The population of the study comprised all crop farmers in Benue State. A sample size of 219 respondents was selected using multistage, purposive and simple random sampling techniques. In the first stage, one local government area was selected from each agricultural zone. These Local Government Areas were selected after consultation with

BNARDA office, and identification of Local Government Areas where they have interventions on climate change. The second stage involved purposive selection of three rural communities from each LGA with regards to the relatively high number of farmers from the communities. From Vandeikya LGA , Mbagbera , Mbatyuogh and Mbakaange rural communities were selected. Yandev, Mbayion and Ipav were selected from Gboko LGA, while Igbanomnaje, Akpegede and Ugboju rural communities were selected from Otukpo LGA. The third stage of sampling involves the simple random selection of 219 farmers from the communities, corresponding to 0.5% of the sampling frame of the communities.

Descriptive and inferential statistics were used to analyse the data for this study. Respondents' age was measured by chronological age of respondents in years, sex was measured as dummy 1=Male and 0=Female, Marital Status was measured as a dummy; Married = 1 and others = 0, level of education was measured by number of years spent in formal education while, farming experience was measured by asking the respondents to indicate the number of years they have been engaged in farming activities and Extension contact was measured as a dummy variable, 1 for those that have contact with extension agents, and 0 for otherwise. On Level of adoption, a four-point Likert-type scale was used to measure adoption level as follows, 3=high adoption, 2=moderate adoption, 1=low adoption and 0=no adoption with a cut off mean of 2.00. Any value below 2.00 was considered as low adoption, while above 2.00 was considered high adoption.

4.0 Results and Discussion

4.1 Socio-economic characteristics

Table 1 reveals that 27.40% of the respondents were between the age brackets of 51 - 60 years, with an average age of 50 years. This is an indication that although the respondents were relatively old, they were actively involved in farming activities in the study area. This result aligns with Ezekiel et al. (2015) and Gbadebo et al. (2022), who reported that farmers in rainforest agro-ecological zone were in their working age.

Table 1 also reveals that majority (55.25%) of the respondents were females, while 44.75% were males. This agrees with UNDP (2010) Kalu and Mbanasor (2023), who reported that, women were mostly involved in climate smart agricultural practices on root crops farming among rural households in Nigeria.

Majority (82.19%) of the respondents were married. Married individuals have more stable household structures and potentially greater access to resources.

Table 1 reveals that, majority (88.58%) of the respondents had formal education. Those with secondary education as the highest educational qualification constituted a significant proportion of (47.03%) as presented in Table 1. This finding agrees with that of Nmadu et al. (2015) who reported that farmers who attained higher level of education and are literate would easily adopt an innovation.

Table 1 further revealed that a significant proportion (47.03%) of respondents own farm sizes below 3 hectares. This could suggest that farming in the study area is on a small scale enterprise and by extension smallholder farmers. It was also found that 69.49% of respondents earned annual income between N500,001- N750,000 Naira. The

respondents are therefore low income earners, who may not be able to facilitate investment in climate smart agricultural practices and cannot pay for labour. This finding is similar to that of Opeyemi et al. (2021) who reported in their study that respondents' income distribution was of low-income group who might not being in position to readily afford or access new agricultural technology in Ika North East, of Delta State.

Table 1 further shows that, majority (64.22%) had household sizes ranging from 6-10 persons. This implies availability of family labour for agricultural activities. Onyeneku et al. (2012) Kalu and Mbanasor (2022), in their study found that household size affects climate change adaptation positively in Nigeria.

The result on extension visits showed that a significant portion (68.49%) of the respondents have not received any extension visits. Rural farmers in the study area were not visited by extension agents frequently. Inaccessibility to extension services according to Gbadebo et al. (2022), is a major barrier associated with adopting new practices and technologies.

Table 1: Socioeconomic Characteristics of Respondents (n=219)

Socioeconomic characteristics	Frequency	Percentage	Mean
Age (years)			
Less than 20	1	0.46	50.32
21-30	16	7.31	
31-40	34	15.53	
41-50	49	22.37	
51-60	60	27.40	
Above 60	59	26.94	
Sex			
Male	98	44.75	
Female	121	55.25	
Marital Status			
Single	14	6.39	
Married	180	82.19	
Widow/widower	22	10.05	
Divorced	3	1.37	
Level of Education			
Non-formal	25	11.42	
Primary	32	14.61	
Secondary	103	47.03	
Tertiary	59	26.94	
Farm Size (hectares)			
=3	103	47.03	3.88
3.1 – 5.0	79	36.07	
5.1 – 7.0	26	11.87	
Above 7.0	11	5.02	
Household size (persons)			
0 – 5	41	18.81	
6 – 10	140	64.22	
11 – 15	34	15.60	
16 – 20	2	0.92	
Above 20	1	0.46	
Annual Income (Naira)			
Less than ₦250,000	3	1.37	3,212,785
250,001 – 500,000	23	10.50	
500,001 – 750,0000	150	69.49	
750,001 – 1000,000	30	13.70	
Above 1 million	13	5.94	
Extension Visit			
No visit	150	68.49	
Once	45	20.55	
Twice	23	10.50	
Thrice	1	0.46	

4.2 Adoption level of climate smart Agricultural Practices

The result on level of adoption of climate smart agricultural practices across agricultural zones is presented in table 2. Findings from Zone A revealed that agroforestry (= 3.00), crop rotation (=3.00) and intercropping with legumes (=3.00) were highly adopted. This is an indication that agroforestry, crop rotation and

intercropping with legumes were highly adopted in zone A region. The high adoption level of these climate smart agricultural practices maybe because of the region's ecological and socio-economic characteristics.

The result on level of adoption of climate smart agricultural practices in 'Zone B' reveals that crop rotation (=2.65), intercropping with legumes (=2.54) and conservation agriculture (=2.54) were highly adopted. This implies crop rotation, intercropping with legumes and conservation agriculture were the climate smart agricultural practices found to be highly adopted in zone B. Conservation agriculture, crop rotation, and intercropping with legumes have high adoption levels as climate-smart agricultural practices in Zone B of Benue State due to the region's unique agro-ecological characteristics. Zone B, has a relatively flat terrain and well-drained soils, making it suitable for conservation agriculture practices like reduced tillage and cover cropping.

The result on level of adoption of climate smart agricultural practices in 'Zone C' reveals that intercropping with legumes (=2.53), crop rotation (= 2.53) and agroforestry (= 2.25) all had high mean values. This is implies that intercropping with legumes, crop rotation and agroforestry were climate smart agricultural practices found to be highly adopted in zone c.

However, the grand mean of the three zones revealed that crop rotation (=2.72), intercropping with legumes (=2.69), agroforestry (=2.43), minimum tillage (=2.39), conservation agriculture (=2.29), contour farming (=2.27), use of safety net (= 2.25), terracing (= 2.18), irrigation (= 2.15) and integrated nutrient management (= 2.16) were adopted in the study area. This implies that there is high adoption level of climate smart agricultural practices in Benue State. This is in line with the findings of Amadu (2018)

who reported high level of adoption of climate smart agricultural practices in Southern Malawi.

Table 2: Distribution of Respondents on Level of Adoption of Climate Smart Agricultural Practices across the Agricultural Zones

CSAP	ZONE A					ZONE B					ZONE C					Grand mean
	NA	LA	MA	HA	Mean	NA	LA	MA	HA	Mean	NA	LA	MA	HA	Mean	
Conservation agriculture	1 (6.25)	0 (0.00)	0 (0.00)	75 (38.66)	2.96	7 (43.75)	2 (18.18)	7 (50.00)	5 (35.71)	2.54	14 (12.50)	9 (64.29)	27 (46.55)	27 (77.14)	1.36	2.29
Agroforestry	0 (0.00)	0 (0.00)	0 (0.00)	76 (40.86)	3.00	7 (25.00)	5 (10.87)	32 (78.05)	22 (21.15)	2.04	54 (29.03)	0 (0.00)	3 (50.00)	18 (66.67)	2.25	2.43
Water harvesting	16 (29.09)	22 (36.67)	2 (4.76)	36 (58.06)	1.76	8 (14.55)	6 (10.00)	32 (76.19)	20 (32.26)	1.96	6 (9.68)	32 (53.33)	8 (19.05)	33 (56.36)	0.85	1.52
Use of safety nets	4 (15.38)	5 (31.25)	1 (1.89)	66 (53.23)	2.69	8 (30.77)	3 (18.75)	27 (50.94)	28 (22.58)	2.13	30 (24.19)	8 (50.0)	25 (47.17)	14 (53.85)	1.92	2.25
Crop rotation	0 (0.00)	0 (0.00)	0 (0.00)	76 (67.86)	3.00	52 (28.89)	0 (0.00)	2 (50.00)	62 (31.96)	2.65	7 (50.00)	4 (36.36)	7 (50.00)	59 (32.68)	2.53	2.72
Intercropping with legumes	0 (0.00)	0 (0.00)	0 (0.00)	76 (41.99)	3.00	10 (38.46)	1 (20.00)	4 (57.14)	51 (28.18)	2.54	8 (50.00)	5 (100.00)	2 (50.00)	62 (31.96)	2.53	2.69
Irrigation	6 (21.43)	11 (23.91)	1 (2.44)	58 (55.77)	2.46	9 (33.33)	0 (0.00)	3 (50.00)	54 (29.03)	2.45	15 (53.57)	8 (19.51)	30 (65.22)	24 (23.08)	1.53	2.15
Minimum tillage	1 (14.29)	74 (54.81)	0 (0.00)	1 (2.04)	2.93	8 (22.36)	5 (35.71)	31 (53.45)	22 (19.64)	2.01	54 (29.18)	4 (80.00)	3 (42.86)	16 (61.54)	2.23	2.39
Contour farming	0 (0.00)	2 (14.29)	5 (45.45)	69 (38.33)	2.84	21 (42.86)	43 (31.85)	9 (32.14)	4 (57.14)	2.18	2 (28.57)	27 (55.10)	19 (67.86)	18 (13.33)	1.80	2.27
Terracing	1 (20.00)	74 (60.16)	0 (0.00)	1 (0.16)	2.93	22 (33.33)	3 (60.00)	10 (40.00)	42 (34.15)	2.18	1 (20.00)	43 (65.15)	15 (60.00)	7 (5.69)	1.42	2.18
Integrated nutrient management	1 (25.00)	1 (1.39)	0 (0.00)	74 (60.16)	2.93	2 (50.00)	22 (30.66)	11 (55.00)	42 (34.15)	2.21	1 (25.00)	49 (68.06)	9 (45.00)	7 (5.69)	1.33	2.16

Key: CSAP- Climate Smart Agricultural Practices, HA-High Adoption, MA-Moderate Adoption, LA-Low Adoption, NA-No Adoption

Cut off mean 2.0

Effect of Socio-economic Characteristics of respondents on their level of Adoption of Climate Smart Agricultural Practices

Logit regression analysis was used to analyse the effect of the socio-economic characteristics of respondents on the levels of adoption of Climate Smart Agricultural Practices. The result is presented in Table 3. From the results, marital status had a coefficient of (0.0168) which is positive and statistically significant at 5% level of

probability. This suggests that married people are more likely to adopt climate smart agriculture practices than unmarried counterparts. This is probably because married individuals maybe perceived to have a greater sense of responsibility and commitment to anything that will enhance their family's well-being. This assumption can motivate them to adopt CSA practices that can improve their household's food security status and resilience to climate change. This implies that the more the number of married farmers, the likelihood of increased level of adoption so as to carryout efficient farming to earn maximum yield for household consumption and surplus to sell for other household needs. This agrees with the findings of Nwaobiala and Notidge (2013) who found in Abia State, Nigeria that marital status significantly influence adoption level of farmers.

Extension visits was found to have a negative coefficient (-0.7379), which is significant at 10% level of probability. The negative coefficient and statistical significance of Extension Visits to the level of adoption of climate smart agriculture practice in Benue State suggests that increased extension visits are associated with lower levels of adoption. This result is counterintuitive, as one would expect extension visits to provide farmers with valuable information and support, leading to increased adoption which is not the case with the finding.

This result raises certain questions of the quality of extension services being provided, the relevance of the information being shared or the timing of the visits and the skills of the extension agents. It is possible that extension agents may not be effectively communicating the benefits of CSA practices or providing adequate support for farmers to adopt these practices. The result underscores the need for critical examination of the extension services being provided in Benue State, to identify areas for improvement and

ensure that they are meeting the felt needs of rural farmers which relates to training extension agents on effective communication and adult learning principles, as well as ensuring that the information being shared is relevant and timely. This finding is contrary to the findings of Nwaobiala and Nottidge (2013) who reported that lack of extension visit leads to low level of adoption of improved soil conservation practices. But in agreement with the findings of Nciizah and Wankindiki (2015) who reported that poor extension visits do not influence adoption level of improved technologies.

From the result, the log likelihood value of -61.053506; and the associated Chi-square value (6.64) is statistically significant at 1 % level of probability. This implies that the model can be relied upon to explain probability of effect of socioeconomic characteristics on adoption level of climate smart agricultural practices in the study area. Furthermore, the significance of the associated Chi-square at 1% level of probability implies that socio-economic characteristics of the respondents has significant effect on adoption level of climate smart agricultural practices in the study area.

Table 3: Logit regression result of socioeconomic characteristics effect on adoption level of climate smart agricultural practices in the study area

Adoption level	Coefficient	Std. Error	Z	p>/t/
Constant	2.3842	1.3512	1.76	0.078
Age	-0.0054	0.0240	-0.22	0.823
Education years	0.0252	0.0716	0.35	0.725
Household size	0.0313	0.0884	0.26	0.793
Annual income	9.6000	3.6600	0.14	0.889
Farm size	-0.0227	0.1626	-0.02	0.981
Marital status	0.0168	0.7003	2.35	0.019**
Extension visit	-0.7379	0.3133	-1.76	0.073*
Chi-square	6.64			
Pseudo R^2	0.0516			
Log likelihood	-61.053506			

**, * 5% and 10% significance level of probability

5.0 Conclusion and Recommendation

5.1 Conclusion

Based on the findings of this research, it was concluded that the respondents had high level of adoption of climate smart agricultural practices among crop farmers in Benue State.

5.2 Recommendations

It is recommended that, the Ministry of Agriculture in the State should recruit more extension agents and also ensure adequate funding to improve extension visits to rural farmers and Extension agents should also educate rural farmers on the benefits of water harvesting as a climate smart agricultural practices to increase their level of adoption.

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