



ASSESSMENT OF SMALL-HOLDER RICE FARMERS' ADOPTION LEVEL OF CLIMATE-SMART AGRICULTURAL PRACTICES IN KWARA STATE, NIGERIA

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ABSTRACT

The study assessed the adoption level of climate-smart agricultural practices by smallholder rice farmers in Kwara State, Nigeria. Cross-sectional survey approach was adopted. A multistage sampling procedure was used to selected 424 samples from the population of 3,727 smallholder rice farmers from the three agricultural zones in Kwara State. Four research questions were raised. Interview schedule was designed by the researcher as instrument for data collection. Data collected was analysed using descriptive statistics in form of percentage, frequency counts, mean and standard deviation. The results indicated high adoption of climate-smart agricultural practices in the study area. It is recommended that Kwara State Government and Non-governmental organizations should provide incentives inform of subsidized inputs to farmers.

Keywords: Climate-smart agriculture, level of adoption, small-holder rice farmers

INTRODUCTION

Climate is an important factor of crop distribution and availability which can be influenced by its changes (Mihailescu & Soares, 2020). The extreme weather conditions such as rainstorms, high wind pressures and high temperatures affect agricultural activities. Climate change can also have effects on human beings and pose threat to the environment and agricultural yields. Climate change induces environmental pollution and depletion of natural resources that greatly challenge sustainable crop production and environment management in modern agriculture (Rojas-Downing *et al.*, 2017). Small-holder farmers in developing countries still rely on rain-fed agriculture, thereby increasing their vulnerability to the consequences of this climate change (Jamshidi *et al.*, 2019). The impacts of the climate change have not been fully understood by these small-holder farmers resulting to being averse to adapt new technologies (Harvey *et al.*, 2019). If not checked through new innovations, climate change is likely to cause considerable crop yield losses, thereby adversely affecting the small-holder farmers' livelihoods, particularly in Nigeria (Food and Agricultural Organization (FAO), 2018). As a result, food security and income generation opportunities for the smallholder farming households that are most reliant on agriculture may be in jeopardy.

Climate-Smart Agriculture (CSA) is a technique to improve investment in an agricultural setting to attain sustainable agricultural progress and ensure food availability under climate change (Amin, Mubeen,

Hammad & Nasim, 2015). The CSA aims to attain sustainable developments of green economy goals, food availability and conservation of natural assets. Food and Agricultural Organization (FAO) develops the CSA practices sustainable land management that engage farmers to sustainably intensification measures such as agroforestry, conservation tillage, residue management, green manuring and improved water management to improve agricultural performance. The CSA packages enable farmers to use their knowledge and skills more effectively, share information, opt for more efficient pro-environmental technologies, and build stronger associations to effectively negotiate better market prices (Anuga, Gordon, Boon & Surugu, 2019).

According to FAO (2017) many people depend on rice for about 80 percent of their calorie requirement, as a result, there is hardly any country in the world where it is not being utilized in one form or the other. In Nigeria, rice seems to be one of the few foods crops whose consumption has no cultural, religious, ethnic or geographical boundary, making it an important food for all.

To support the ever-increasing demand for higher grain yields in rice, farmers are increasing plant densities in their management schemes, which has resulted in an increased population of certain pests, poor water management, loss of soil nutrient and spoilage of farm produce as mitigation strategies. It is estimated that rice production through various CSA technique increase by 114 million tons by 2035, which farmers must achieve

under significant threats from climate change (De Pinto *et al.*, 2020). Doing so, will enhance the level of current food production and reduce food insecurity. It has been noted that increasing food production with minimal adverse impact on resources and the environment is the greatest challenge for food security (FAO, 2017). This study therefore deemed it pertinent to assess the level of adoption of CSA practices by smallholder rice farmers in Kwara State to provide baseline information for further planning and policy formulation that concerns CSA and smallholder rice farmers in Kwara State and areas with similar conditions in Nigeria.

Research Questions

In line with the objectives of the study, the following research questions were answered:

- i. What are the socio-economic characteristics of small-holder rice farmers involved in CSA practices in Kwara State?
- ii. What is the level of adoption of CSA practices among small-holder rice farmers in Kwara State?
- iii. What are the categories of CSA adopted practices in Kwara State?
- iv. What are the areas of CSA adopted practices not satisfied with by smallholder rice farmers in Kwara State?

The specific objectives are to:

- i. described the socio-economic characteristics of small-holder rice farmers involved in CSA practices in Kwara State;
- ii. determined the level of adoption of CSA practices among small-holder rice farmers in Kwara State;
- iii. categorize the level of adoption of CSA practices in Kwara State; and
- iv. identify areas of CSA adopted practices not satisfied with by smallholder rice farmers in Kwara State.

METHODOLOGY

Cross-sectional survey design was used to assess the adoption level of CSA practices by small-holder rice

farmers' in Kwara State. The population for the study comprised of 3,727 registered rice farmers in Kwara State. According to the Kwara State Agricultural Development Projects (KWADP) rice farmers are divided into three agricultural zones A, B and C based on ecological characteristics, political, cultural practices, and administrative convenience. The registers of rice farmers from the three agricultural zones in the selected areas of the study were used as sample frame to select respondents. A multistage sampling technique was used to select the sampled respondent. The first stage involved random selection of two Local Governments Areas (LGAs) from each agricultural zone to make up six local government areas. While, the second stage involved a random selection of one community from each of the six selected LGAs. All the registered farmers in the selected communities were used as sample size which gave a total of 424 respondents. Interview schedule was used to generate the data because it provided flexibility to the respondents who could not read and interpret question items correctly. The instrument was based on respondents' socio-economic characteristics, level of adoption of CSA practices and areas of CSA adopted practices not satisfied. The scoring of options for each item ranged from one to five, that is, Very low=1, Low=2, Moderate=3, High=4 and Very high=5. The instrument was validated by research experts from the National Agricultural Extension Research and Liaison Services (NAERLS) Ahmadu Bello University, Zaria, who perused and scrutinized each item to meet up with the criteria of face and content validity of the instrument. To ensure reliability of the instrument, 20 registered smallholder rice farmers in Egbejila, Asa LGA were selected and used for pilot testing the instrument. Choice of Egbejila was because the community has similar characteristics with the study area being part of the population. The Guttman Split-Half Coefficient of the instrument was 0.69. The instrument was converted electronically into smart phone embedded Open Data Kit for easy coding of the data collected. Descriptive statistics in form of frequency counts, percentage, mean and standard deviation were used to analyzed the data collected.

further shows that majority of the smallholder rice farmers were male (92.7%) and only (7.3%) were female. This implies that rice farming in Kwara State is male dominated which might not be unconnected with the general believe that farming is laborious and hence, meant for the male fork. This is in line with the findings of a study conducted by Abur, (2014) who concluded that rice farming is male dominated, with about 75% of the respondents being men.

RESULTS AND DISCUSSION

According to table 1, the average age of smallholder rice farmer in Kwara State to be 39.45 years, falling within a productive youth age and Standard Deviation (SD) of 11.37. This finding is in line with that of Bello, *et al.* (2020) who reported that majority of rice farmers belonged to productive middle age group in Nigeria Yet, the finding

Further, the study shows that majority of the smallholder rice farmers had no formal education (44.3%) with least number (4.5%) of the respondents having tertiary education. This finding negates that of Abur, (2014) who stated that majority of rice farmers were literate, with 53% of them having attended secondary school in Benue State. The finding also contradicts the study of Krishnamurthy, *et al.* (2018) who concluded that nearly half of the paddy growers (58.33%) in developing countries had middle school to high school education.

This study shows that smallholder rice farmers had an average of 3.72(ha) of land cultivated which is contrary to the findings of Lowder *et al.* (2016) who asserted that smallholder farmers had less than 2 hectares of land around

the world. Again, this finding reveals a mean score of 4 persons per household for male and female. This means that family labour use is imminent among smallholder rice farmers agreeing with the findings of Ogunniyi *et al.* (2021) who concluded that 62% of smallholder farmers had household size of between 4 to 6 members. The result shows that majority of smallholder rice farmers (71.2%) had between 1-10 years of farming with a mean of 9.81 years in farming. This implies that majority of smallholder rice farmers in Kwara State are experienced. This finding is in line with the finding of Yusuf and Mustapha (2019) who concluded that majority (41.67%) were experienced farmers with 16 - 25 years of farming experience in rice production. This is an indication that rice farmers in the area will not likely be averse to adopting CSA practices.

Table 1: Result of socio-economic characteristics of small-holder rice farmers involved in CSA practices in Kwara State (N=424)

Variable	Group	frequency (f)	percentage (%)	Explanation
Age (years)	≤20 - 30	56	13.2	Mean: 39.65 SD: 11.37 Minimum: 22 Maximum: 75
	31 - 40	215	50.7	
	41 – 50	81	19.1	
	51 – 60	52	12.3	
	>60	20	4.7	
Sex	Male	393	92.7	Mode: Male
	Female	31	7.3	
Level of education	No formal education	188	44.3	Mode: No formal education
	Quranic education	61	14.4	
	Primary education	87	20.5	
	Secondary education	69	16.3	
Size of rice farm (ha)	Tertiary education	19	4.5	Mean: 3.72 SD: 0.98
	≤3ha	179	42.2	
	3.1 – 5.0ha	231	54.5	
Household size (male)	>5.0ha	14	3.3	Mean: 4.00 SD: 2.00
	≤3	226	53.3	
	4 – 6	147	34.7	
Household size (female)	>6	51	12.0	Mean: 4.00 SD: 2.00
	≤3	208	49.1	
	4 – 6	175	41.3	
Farming experience (years)	>6	41	9.7	Mean: 9.81 SD: 5.79
	1 – 10	302	71.2	
	11 – 20	70	16.5	
	>20	52	12.3	

Source: Field Survey (2021). SD= Standard Deviation

Table 2 revealed that incorporating refuse into the soil rather than burning adopted level was high (94.3%) with a mean of 4.26. This shows that adopted level of CSA tillage and residue management was high in the

study area. The finding reveals that ploughing and harrowing was adopted at high level (100%) by smallholder rice farmers in the study area. Also, cultivation of early maturing and drought resistant

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varieties was high (100%) by the smallholder rice farmers. This implies that smallholder rice farmers' adopted level of CSA agronomic practices was high in Kwara State. The finding shows that efficient application of fertilizer in split/small but repeated dosages based on assessment of rice needs using soil test/analysis adopted level was high with (94.4%) with a mean of 4.38. This implies that CSA integrated soil fertility management adopted level was high by smallholder rice farmers in the study area, this therefore will reduce the adverse effect of habitual usage of synthetic fertilizer which is detrimental to man and the environment. Furthermore, the finding shows that

construction of drainage system in case of flooding was adopted at (100%) level by smallholder rice farmers with a mean of 4.78. This implies that CSA water management adopted level by smallholder farmers in Kwara State was high. The finding shows that blending of chemical and other control measures to control pests by smallholder rice farmers was adopted at (98.1%) with a mean of 4.35. Also, blending biological and other control measures to control pests was adopted at (98.6%) with a mean of 4.33. This implies that adopted level of CSA integrated pest management by smallholder rice farmers in the study area was high.

Table 2: Distribution of respondents by adoption level of CSA practices in Kwara State, Nigeria

Climate-Smart Agricultural Practices	VL (%)	LW (%)	MO (%)	HG (%)	VH (%)	Mean (\pm SD)	Remark
Incorporating refuse into the soil rather than burning.	0	5.7	15.3	26.4	52.6	4.26 \pm 0.92	High
Ploughing and harrowing.	0	0	9.4	36.3	54.2	4.45 \pm 0.66	High
Cultivating early maturing and drought tolerant rice varieties.	0	0	18.9	35.8	45.3	4.26 \pm 0.76	High
Intercropping cover crops with rice to improve soil fertility.	0	0	12	29.5	58.5	4.46 \pm 0.70	High
Cultivating and ploughing in leguminous plants into the soil as green manure.	0	5.7	9.2	28.1	57.1	4.42 \pm 0.74	High
Efficient application of fertilizers in split - small but repeated dosages based on assessments of rice needs using soil test/analysis.	1.2	4.5	11.3	28.1	55	4.38 \pm 0.76	High
Mulching to conserve soil moisture.	0	0	11.1	29.7	59.2	4.48 \pm 0.69	High
Construction of drainage system in case of flooding.	0	0	0.7	20.5	78.8	4.78 \pm 0.43	High
Blending chemical and other control measures to control pests.	0.9	0.9	15.8	27.1	55.2	4.35 \pm 0.85	High
Blending biological and other control measures to control pests.	0	1.4	18.4	26.4	53.8	4.33 \pm 0.82	High
Integrating cultivation of appropriate tree species along with rice on farm land.	0	0	13.4	29.2	57.3	4.44 \pm 0.72	High

Source: Field survey (2021). SD= Standard Deviation

Note: any mean score of 3.0 and above was regarded as high adoption level, while mean value below 3.0 was considered as low adoption level. VL= very low; LW= Low; MO= Moderate; HG= High; VH= Very High

This therefore will reduce the adverse effect of habitual usage of synthetic chemical which has detrimental effect on man and the environment. The finding reveals that integration of appropriate tree species along with rice on farm land adopted level was high (100%) with a mean of 4.44. This implies that CSA agro-forestry adopted level was high among smallholder rice farmers.

These findings contradict that of Tihamiyu, Ugalahi, Fabunmi, Sanusi, Fapojuwo and Shittu, (2017),

Oyawole *et al.* (2020) and Olayide *et al.* (2016). Tihamiyu, *et al.* (2017) conducted a research on analysis of farmers’ adoption of climate-smart agricultural practices in Northern Nigeria. The results of the study showed that adoption of selected CSA practices was generally low. Oyawole *et al.* (2020) conducted a similar research in Northern Nigeria, the study reported that CSA adoption was generally low in Northern Nigeria. Olayide *et al.* (2016) reported that adoption of CSA practices in Nigeria was low.

The result in table 3 shows that no farmer adopted the CSA practices at a very low level of adoption, this is due to the general belief that smallholder rice farmers in Kwara State are not averse to adoption of agricultural technologies 7.2% of the smallholder rice farmers in Kwara State had low level of adoption while 20.8% smallholder rice farmers moderately adopted the CSA practices. The findings also shows that most of the smallholder rice farmers (45.8%) adopted the CSA practices at a high level of adoption while 26.2 % of the smallholder farmers adopted the CSA practices at a very high level. Therefore, adoption of CSA practices by smallholder rice farmers is high in Kwara State, Nigeria

Table 3: Categorization of respondents by level of adoption of CSA practices in Kwara State, Nigeria

Categorization of adoption	Adoption Index fractile	Frequency (%)	Percentage (%)
Very low adoption	0.0 – 20.0	0	0
Low adoption	21.0 – 40.0	31	7.2
Moderate adoption	41.0 – 60.0	88	20.8
High adoption	61.0 – 80.0	194	45.8
Very high adoption	81.0 - 100	111	26.2
Total		424	100

Source: Field survey (2021)

The result in figure 1 shows that 30.0% of the smallholder rice farmers in Kwara State are unsatisfied with integrated pest management practice, this may be connected with the fact that chemical use has financial implications and the emergence of new pest species. The findings shows that water management (9%) is the least unsatisfied CSA practices adopted by smallholder rice farmers in the study area, this being the least unsatisfied maybe be due to frequent need for water control which help prevent rice farms from over flooding. This finding is in line with Autio *et al.* (2021)

who concluded that farmers are knowledgeable regarding environmental change and climate-smart practices but are confined by limitations and restrictions posed by lack of resources. The finding is also corroborated with Autio *et al.* (2021) who concluded that emergence of new pest species is a major factor to adoption of CSA integrated pest management practices. The finding is also in line with Antwi-Agyei *et al.* (2021) who asserted that limited government support with farm inputs is factor preventing rice farmers from adoption of CSA practice.

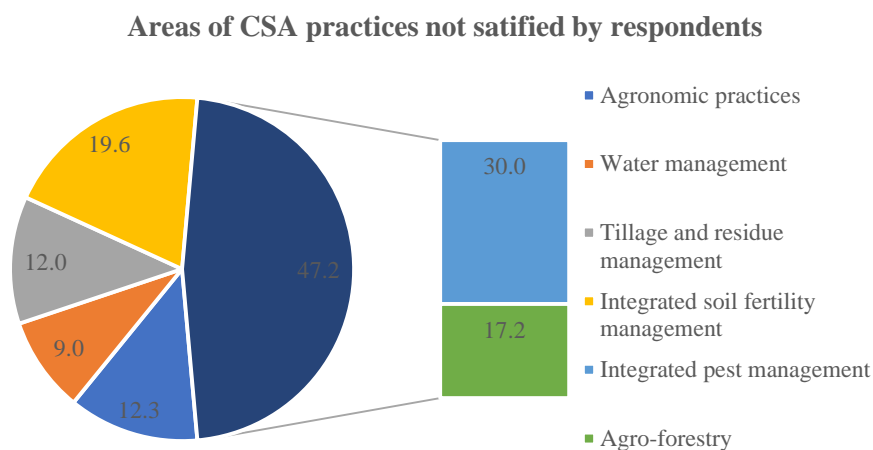


Figure. 1: Distribution of respondents by areas of CSA practices not satisfied with in Kwara State, Nigeria
Source: Field survey (2021)

CONCLUSION AND RECOMMENDATIONS

From the findings of the study, it is concluded that rice production in Kwara State is male dominated due to the general believe that farming is for the male forks. Climate-smart agricultural adopted practices were high which indicates that smallholder rice farmers in Kwara State are not averse to adopting CSA practice since majority of them are youths who are eager to take risk. Intergrated pest management practice is the least satisfied practices by smallholder rice farmers due to emergency of new pest species. Smallholder farmers should be encouraged to maintain high adoption of climate-smart agricultural practices through extension service delivery to mitigate the adverse effect of habitual usage of synthetic chemicals that are detrimental to man and the environment. Kwara State Government and Non-governmental organizations should make incentives inform of inputs available to farmers and also retrain them as some of them are not satisfied with certain CSA practices. More female should be encouraged to go into rice farming and adopt CSA practices through community self-help initiatives.

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