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Perception of Maize Farmers on Effectiveness of Climate Smart Practices in Guinea Savannah and Rainforest Agro-Ecological Zones of Oyo State, Nigeria

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ABSTRACT

Climate smart practices have been recognised to sustainably increase agricultural productivity and farmers' incomes while adapting to climate change effects. This study identified climate smart practices adopted within the study area and assessed the effectiveness of these climate smart practices in selected agro-ecological zones of Oyo State. Multistage sampling technique was employed in the selection of farmers. First stage was purposive selection of Ibadan/Ibarapa and Shaki Agricultural Development Zones while at the second stage 2 blocks from each ADP zones were simple randomly chosen. The third and final stage involved random selection of 4 cells from each block and 10 registered farmers from each cell to make a total sample size of 160 registered farmers. But only 140 questionnaires were retrieved and used for the analysis. Descriptive statistics such as frequency, percentages were used for data analysis. Results obtained show that majority of the farmers adopted one climate smart practices or the other. The commonest responses to climate change in the study area are planting date to suit onset of rainfall (97.9%), use of chemicals/pesticides to fight pests and diseases (93.6%), adoption of intercropping/mixed cropping system (87.9%). Almost all (97.9%) of the farmers changed their planting date to suit onset of rain. More than one third (38.6%) of maize farmers indicated that the adoption of climate smart pratices increase their maize output while another quarter (25%) said climart smart practises doubled their maize yield. Thefarners all (100%) affirned that increase in maize yield led to increase in their income. This study therefore concludes that climate smart practices is beneficial for increase yield and income.

Keywords: Perception, Maize, Climate Smart Practices, Agro-ecological Zones, Oyo State

Introduction

Climate change impacts have been confirmed to reduce the capacity of natural resources to sustain the food demand of the world's increasing population (FAO, 2019). Several studies have documented the impacts of climate change across the globe (Arora, 2019; Enete, 2014; Ibrahim *et al.*, 2014 United Nations, 2018).

World population is increasing day by day and at the same time agriculture is threatened due to natural resource degradation and climate change. Production stability, agricultural productivity, income and food security is negatively affected by changing climate (Nagargade *et al*., 2017). Therefore, agriculture must change according to present situation for meeting the need of food security and also withstanding under changing climatic situation. Projected estimates based on food consumption pattern and population growth show that agriculture production will require enhancing by 65% to meet the need of burgeoning population by 2050 (Nagargade *et al*., 2017).

Agriculture is a prominent source as well as a sink of greenhouse gases (GHGs). So, there is a need to modify agricultural practices in a more sustainable way to overcome these problems. Developing climate resilient agriculture is thus crucial to achieving future food security and climate change goals. It helps the agricultural system to resist damage and recover quickly by adaptation and mitigation strategies. Climate-smart agriculture (CSA) is an approach that aims to transform, reorient, and develop agricultural systems based on digital technologies, aiming to contribute to an increase in global food security as part of climate change adaptation and mitigation reports (FAO, 2010; Hellin and Fisher, 2019).

Inrural areas of Africa where most of the farming activities are concentrated, climate change is perceived by smallholder farmers in terms ofsoil erosion and flooding because of heavy downpour, increased soil water stress and excessive heat among others (Adeola *et al*., 2012 and Omotosho *et al.*, 2000).Excerpts from several studies on climate change in guinea savannah and rainforest zones of Nigeria showed rainfall variability and rising temperature as main evidence of climate change in the zones (Ayanlade *et al*., 2010; Idowu *et al.,* 2011; Srivastava *et al.,* 2012). Although, the variability of rainfall in the rainforest zone is lesser when compared to that of guinea savannah (Ayanlade *et al.,* 2018).

Yet, this gave a true reflection of rainfed agricultural system characterising the nature of most smallholder farmers in Nigeria (Adejuwon, 2006; Odekunle *et al.,* 2007). Thus, the vulnerability of these smallholder farmers to varying climate pattern is inevitable. The menace is much more on maize crop which is the main crop grown in the study area due to the suitability of the soil and consumption pattern of major households including demand from agro-based industries (Adejuwon and Odekunle, 2006).Absence of rainfall leads to off-season of some produce like maize, vegetables and use of irrigation by few who could afford it increases the price of such crops due to increase in cost of production. This contributed to the reasons for changes in diet of farming and non-farming households, as well as declined production of agro based industries including feed mills.

Adeola *et al.* (2012); Ajao and Ogunniyi (2011) acknowledged several responses adopted by farmers especially the maize producing farmers to mitigate the menaces instigated by climate change, knowing that maize cropping is much more dependent on rainfall. With climate change already compounding the socioeconomic and biophysical constraints to development in West Africa, the adoption of climate-smart agriculture (CSA) is one mainstream opportunity to improving food and livelihood security in the region (Partey *et al*., 2018).Some of the adaptation strategies include changing planting dates to suit the onset of raining season, cultivating improved varieties of planting materials that are resistant to pest, diseases or drought and application of fertilizer or manure to improve soil fertility. Some agronomic activities such as crop rotation, mulching, mixed cropping, intercropping, bush fallowing that were not given precedence became some of the adaptive measures employed for this purpose. Adoption of crop insurance was observed among some commercial farmers while smallholders who were less resilient exit farming for non-farming activities.

However, Osuafor and Nnorom, (2014) and Ayanlade, (2009) admitted the adoption of climate smart practices by farmers in Oyo State but they have been silent about reporting its effectiveness through farmers' perception. For example, Ayanlade *et al.*, (2018) through a focused group discussion with smallholder farmers in guinea savanna and rainforest zone of Oyo State identified changing planting date, reducing scale of production, planting resistant varieties and mulching of soil as the main coping strategies adopted by maize farmers to adapt to drought condition and rainfall.

It is in this respect that this study finds it worthwhile to assess the perception of maize farmers on effectiveness of climate smart practices in the study area. Specifically, the study aims to identify the climate smart practices adopted by farmers in the study area as well as assess the perceived effectiveness of adopted climate smart practices in adapting to climate change impacts in the study area.

Methodology

The Study Area

This research was carried out in Oyo state which is one of the agrarian zones in the Southwest region of Nigeria. The dominant vegetation are guinea savannah and tropical rainforest with commonly grown crops including cassava, maize, yam, vegetables, cowpea and other food crops. The State is grouped into four main agricultural zones namely Ibadan/Ibarapa, Oyo, Shaki and Ogbomosho Agricultural Development Zone (ADP). However, this study focused on Ibadan/Ibarapa and Shaki ADP zones due to their distribution across the needed agroecological zones and implementation of Government interventions/projects in the area on climate smart practices. Based on the climatic features characterising each zone, Ibadan/Ibarapa was classified as a rainforest zone while Shaki was identified as a guinea savannah zone.

Sample Size, Sampling Procedure and Method of Data Collection

Multistage sampling technique was employed in the selection of farmers for this study. In the first stage, purposive sampling technique was used to select two Agricultural Development Zones (Ibadan/Ibarapa and Shaki), which covers rainforest and guinea savannah respectively according to Nigerian Ministry of Agriculture classification. Second stage involved the use of simple random sampling to select 2 blocks from each ADP zones, while the third stage involved the random selection of 4 cells from each block. And the final stage involved the random selection of 10 registered farmers from each cell to make a total sample size of 160 registered farmers. Based on this sampling procedure, 80 registered farmers were selected from guinea savannah (Ibadan/Ibarapa zone) and 80 from rainforest zone (Shaki zone). Data were then collected using structured questionnaires facilitated by agricultural extension officers. Meanwhile, 140 questionnaires were retrieved and used for the analysis.

Method of Data Analysis

Data were analysed using descriptive statistics such as frequency tables, percentages and bar charts.

Results and Discussion

Socio-economic characteristics of the respondents

The socio-economic characteristics of the respondents were presented in Table 1. It shows that the average age of farmers in the study area is 55 years while the standard deviation is 13.4. The high standard deviation (13.4) of the respondents' age distribution is explained by the high polarity of individual farmer's age. This result confirms the study of Sangotegbe *et al*. (2012) and Ezekiel *et al*. (2015) who reported that the mean age of farmers in guinea savannah and rainforest zone is 52. A larger percentage (87.9%) of farmers in the study area were male while few (12.1%) of them were females. This reflected the results obtained by Fadoyin *et al.*, (2015) and Ezekiel *et al. (*2015) that most farmers in guinea savannah and rainforest zones were male. Majority (40.7%) of the farmers had secondary education while very few (2.1%) had tertiary education. 20.7% had no formal education while 26.4% had primary education. This implies that majority of the farmers have attained significant level of literacy which corroborates the results obtained by Fadoyin *et al*. (2015).

Analysis from Table 1 further revealed that majority (86.4%) of the farmers practice farming as their main occupation when compared to limited number of them (13.6%) who engaged in non-farm activities as their primary occupation. This result agrees with the study of Apata *et al.* (2009) that majority of farmers in both guinea and rainforest zones have farming as their main occupation with few practicing it as a secondary occupation. In terms of year of farming experience results show that larger percentage (39.3%) of the farmers surveyed had farming experience between11 to 20 years. The maximum year of farming experience in the study area is 60 years while the average years of farming experience among the farmers is 21.5 years. This result confirms the report of Ayanlade *et al.* (2017) that revealed the years of farming by most farmers in the study area as 20 years.

Table 1: **Summary statistics of selected socio-economic characteristics of the respondents**

Variable		Frequency (%)	Mean	Min	Max	Standard dev.
Age						
	=30	7 (5)				
	31 - 40	16 (11.4)				
	41 - 50	27 (19.3)	55	27	85	13.4
	51 - 60	47 (33.6)				
	Above 60	43 (30.7)				
Gender						
	Male	123 (87.9)				
	Female	17 (12.1)				
Level of education						
	No formal	29 (20.7)				
	Primary	37 (26.4)				
	Secondary	57 (40.7)				
	Tertiary	17 (2.1)				
Marital Status						
	Single	10 (7.1)				

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	Married	116 (82.9)				
	Widow	11 (7.9)				
	Divorced	3 (2.1)				
Household size						
	= 5	17 (12.1)				
	6 – 10	89 (63.6)	8	1	27	3.6
	11 – 15	31 (22)				
	Above 15	3 (2.1)				
Primary occupation						
	Farming	121 (86.4)				
	Non-farming	19 (13.6)				
Years of farming experience						
	= 10	29 (20.7)				
	11 – 20	55 (39.3)	21.5	1	60	
	21 – 30	25 (17.9)				
	31 - 40	24 (17.1)				
	Above 40	7 (5)				
	Total	140 (100)				

Source: Field Survey

Livelihood Characteristics of the respondents

Results from Table 2 shows that 68.6% of maize farmers in the study area had access to labour, which could be family or hired labour. This implies that majority of the farmers had access to labour in one form or the other. The result also shows that 60% of farmers sampled in the study area cultivated on less than 1 acre of land while only 20.7% cultivated on 2.5 acres and above, implying that majority of the farmers do not have large farm size that could support large commercial farm operations.

Also, majority of the farmers acquired their farmland through inheritance, which could account for the small size of farmland under cultivation by the farmers in the study area. In terms of yield per acre, the result shows that the average maize yield per acre harvested by most farmers in both zones was about 246.4kg. This implies that the yield of maize cultivated by farmers is still very low.

Table 2: Distribution of respondents based on livelihood characteristics

Variable		**Frequency (%)**	**Mean**
Access to Labour			
	Yes	96 (68.6)	
	No	44 (31.4)	
Farm size in acres			

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	0.25 - 1.00	84 (60)	
	1.01 – 2.50	27 (19.3)	1.79
	Above 2.50	29 (20.7)	
Type of farmland ownership			
	Rented	15 (10.7)	
	Lease	14 (10)	
	Inherited	97 (69.3)	
	Purchase	14 (10)	
Maize yield per acre (bags)			
	1 – 3	52 (37.1)	
	4 – 6	57 (40.7)	4.48
	Above 6	31 (22.1)	

Source: Field Survey

Climate smart practices adopted by farmers in adapting to various climate change scenarios

Table 3 below shows climate smart practices adopted by farmers in adapting to various climate change scenarios and impacts experienced in both guinea savannah and rainforest zone of Oyo State. Almost (97.9%) all the farmers investigated adjusted the planting date of maize to suit the onset of rainfall while the remaining 2.1% do not change planting date. Some of the farmers within the study area sowed their seeds at the start of every planting season using irrigation facilities until a stable rainfall is assured. This result upholds the claims of Kotir (2010) and Ayanlade *et al.* (2018) that majority of smallholder farmers' plant only when rain is steady rather than planting in the start of farming season. Based on the results obtained from analysed data, 76.4% of the farmers interviewed adopted irrigation facilities as an adaptation strategy for the short drought periods that sometimes emerges in the middle of planting season or delayed onset of rainfall while 23.6% were observed not to practice irrigation. This result confirms the reports of Ajao and Ogunniyi, (2011), Ayanlade *et al.* (2018) and Ajetomobi *et al.* (2010) that farmers often use irrigation as an adaptation strategy to climate change.

Regarding adapting planting techniques to adapt to climate change scenarios and impacts, majority (85.7%) of the farmers used fertilizer to improve their soil health and (93.6%) used pesticides to control pest and disease infestation. Larger percentage of farmers in the study area adopted the use of improved seeds to increase resilience of maize crop to climate change impacts while little less than average (49.4%) practiced mulching. These results were in consonance with the reports of Ogalla *et al.* (2017) and Alo *et al.* (2017) that majority of the farmers in the study area use fertilizer, mulching materials, pesticides and improved seeds to improve impoverished soil, yields, control erosion, pests and diseases. Many farmers did not practice mulching because maybe they felt most of the crops (cassava, beans, millet) intercropped with maize do not need to be mulched as most of the creeping plants served as live mulch.

Apart from adjusting planting calendar or adapting planting techniques as an adaptation measure, some farmers were observed to adopt certain cropping system in other to adapt to the climate change impacts. 75% of farmers sampled adopted crop rotation as against 35% that did not adopt. 87.9% of the farmers practised intercropping and mixed cropping while few of the farmers (39.3%) engaged in agroforestry practices. These results are in line with the study of Alo *et al.* (2017) and Ajao and Ogunniyi, (2011). Majority of the farmers see these adaptive practices as cost effective that could offset losses from other crops and also conserve soil fertility. The reason for low adoption of agroforestry could be explained by the waiting period of the trees to mature.

Observations from the result table likewise indicate that farmers also diversify income sources exclusively or in addition to other agronomic practices so as to effectively adapt to climate change impacts. Seemingly, 42.1% of the farmer within the study area changed from crop farming to livestock rearing. 34.3% opted out of farming to start off-farm activities, 59.3% combined both off-farm and farming together while 56.4% integrated livestock farming with crop farming. Additionally, 62.9% of the farmers go out of their farming communities to search for other means of livelihood to increase their wages.

Table 3: Distribution of respondents by responses to climate change

Variable	Frequency (%)	
	Yes (%)	No (%)
Adjusting Planting Calendar		
Changing Planting date to suit onset of rainfall	137(97.9)	3 (2.1)
Adapting Planting Techniques		
Use of Irrigation Facilities especially in drought season	107 (76.4)	33 (23.6)
Manure/Fertilizer application to improve soil health	120 (85.7)	20 (14.3)
Use of Chemicals/Pesticides to fight pests and diseases	131 (93.6)	9 (6.4)
Increasing the number of labour that works on the farm	86 (61.4)	54 (38.6)
Use of Improved Seed Varieties (drought or disease resistance varieties)	93 (66.4)	47 (33.6)
Use of mulching techniques	69 (49.3)	71 (50.7)
Adapting Cropping System		
Adoption of crop rotation	105 (75)	35 (25)
Adoption of intercropping/mixed cropping system	123 (87.9)	17 (12.1)
Agroforestry practices	55 (39.3)	85 (60.7)
Diversifying Income Sources		
Changing from crop farming to livestock farming.	59 (42.1)	81 (57.9)

Changing from farming to non-farming activities.	48 (34.3)	92 (65.7)
Combining off-farm activities with farming activities.	83 (59.3)	57 (40.7)
Integrating livestock farming with crop farming.	79 (56.4)	61 (43.6)
Other Measures		
Migration away from farming community to seek wage or other employment (or Diversification from farming to other economic activities)	88 (62.9)	52 (37.1)

Source: Field Survey

Distribution of respondents bythe perceived effectiveness of climate smart practices on maize yield

Figure 1 shows the distribution of respondents by the perceived effectiveness of climate smart practices on maize yield. Result from the figure shows that all the farmers in the study area experienced yield increase due to the perceived effectiveness of the climate smart practices adopted. Apparently, more than one third of maize farmers (38.6%) had just a little increase in their maize output while 25% of the respondents had double increase of maize yield. 15% of the farmers within the study area revealed that they had one and half yield increase in their maize output while 21.4% claimed to have more than double yield increase in maize output. Figure 2 shows the perception of yield increase on income of maize farmers. Thefarners all (100%) affirned that increase in maize yield led to increase in their income. By extension, the adoption of climate smart practises will impact positively on yield and income.

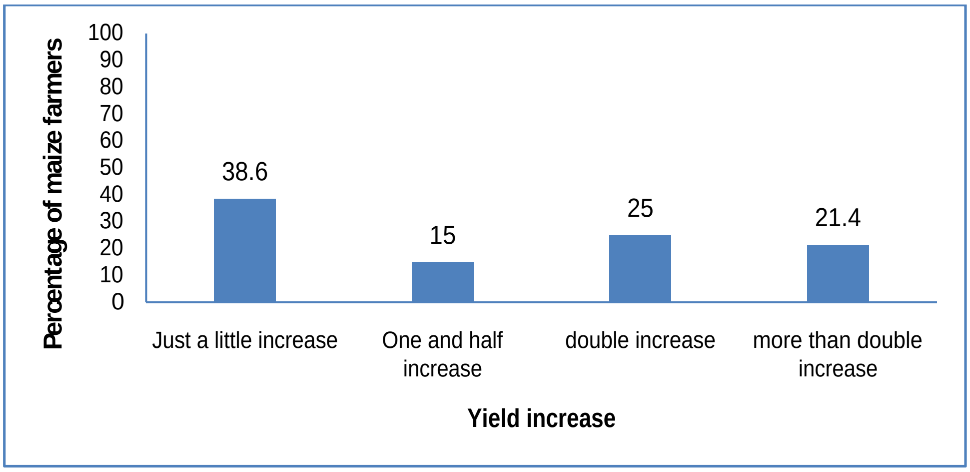

Figure 1: Distribution of respondents by effect of climate smart practices on yield increase

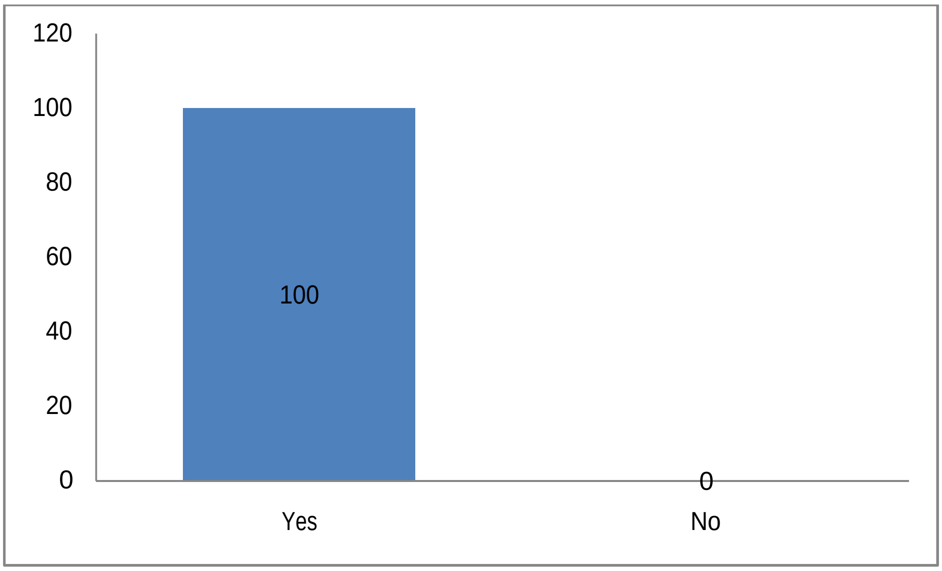

Figure 2: Distribution of respondents by effect of yield increase on income

Conclusion and Recommendation

Findings from this study revealed the various climate smart practices adopted by farmers and the perceived effectiveness of the adopted climate smart techniques in guinea savannah and rainforest zones of Oyo state. This study therefore concludes that climate smart practices is beneficial for increase yield and income. Therefore, concerted effort should be directed to development of suitable policies that will encourage farmers to adopt climate smart techniques.

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