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FARMERS' PERCEIVED EFFECTS OF CLIMATE CHANGE ON SELECTED FOOD CROP PRODUCTION IN EDO AND ONDO STATES OF NIGERIA

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ABSTRACT

This study examined the perceived effects of climate change on farmers' level of food crop production in Nigeria. Edo and Ondo States were selected for the research work. A multi-stage sampling procedure was used. The selection was based on farmers growing the three food crops namely cassava, maize and rice. Chi square test and Pearson Product Moment Correlation were used to test for the hypotheses. The study revealed the average output of cassava (19.09 tonnes), maize (2.72 tonnes) and rice (4.97 tonnes).The study revealed that the respondents perceived effects of climate change on the following: decline in crop yield ($\bar{x}$ = 3.07), high cost of food crop production ($\bar{x}$ = 3.25) and increase use of agrochemicals ($\bar{x}$ = 3.00). Correlation analysis revealed that the age of farmers had a negative and significant relationship with the perceived effects of climate change (r = -0.16, P = 0.02) at P < 0.05 level. The correlation analysis also revealed that both the average cassava output (r = 0.23, P = 0.00) and average rice output production (r = -0.19, P = 0.00) are significantly related to perceived effects of climate change at 0.05 level of significance. In conclusion, majority of the farmers were more adequately aware of the perceived effects of climate change on food crop production. The study therefore, recommended that there is need for appropriate stakeholders to provide farmers with necessary input in order to reduce adverse effects of climate change on their food crop production.

Keywords: Climate Change, Farmers, Food Crop, Perceived Effects, Production.

INTRODUCTION

Climate change, as stated by the United Nations Framework Convention on Climate Change mean changes in the physical environment which have significant deleterious effects on the composition, or production of natural and managed ecosystems as well as on human health and welfare (UNFCCC, 2003). Climate change affects physical process in many parts of the world, leading to changes in temperature and rainfall patterns, wind direction, increased intensity and frequency of extreme event like drought; floods and cyclones (Tubiello *et al.,* 2007). Climate change has significant impacts on conditions (temperature, precipitation, carbon dioxide, wind and so on) affecting agriculture, and these conditions determine the capacity of the biosphere to produce enough food for the human population as well as domesticated animals (UN, 2007). The agriculture sector has multiplier effects on any nation's socio-economic (Stewart, 2000; Ogen, 2007). Climate plays a dominant role in agriculture having a direct impact on the productivity of physical production factors like the soil's moisture and fertility (Smith and Skinner, 2002). Climate change affects crop growth, soil water availability, soil erosion, drought, flood, sea level rise, pest and disease infestation which in turn affect agriculture, food supply, fresh water resources and human health (Zoellick and Robert, 2009). The growing problem of climatic change impact is global and the developing countries, especially, Africa will be mostly affected. This is because, African agriculture is predominantly rain-fed and fundamentally dependent on weather (heavily susceptible to environmental factors) (Ziervogel *et al*., 2006: Jagtap, 2007). It is also characterised by inability to cope as a result of poverty and low technological development, hence, low level of cropping, capabilities by the farmers (Nwajuiba *et al.,* 2010; Onyenechere, 2010).

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A significant effect of climate change due to increased levels of carbon dioxide could be reflected in the production of crops like cassava, yam, cowpea, wheat, soybean, rice, potatoes, millet, sorghum, maize (Adejuwon, 2004). When temperature exceeds the optimal level, crops response negatively thus resulting in a drop in net growth and yield (Fisher *et al*., 2002). The poorest countries would be greatly affected with a high reductions in crop yields in most Tropical and sub-Tropical regions due to decrease water availability, changes insect pest incidence (IPCC, 2001). The impacts of climate change on food production, prices, and food security depend on regional climate change, biological effect of increasing atmospheric carbon dioxide, changes in floods, drought extreme events, existing agricultural systems, adaptive capacity, change in population and technological innovation (Pittock, 2005).Nigeria is one of the developing countries that climate change impact will be more severe (Odjugo, 2010) and its impact will result in poor and unpredictable yield thereby making farmers more vulnerable (UNFCCC, 2007) because, agriculture is the main source of food and employer of labour in the country (Mayong *et al.,* 2005). It is a significant sector of the economy and the source of raw materials used in the processing industries as well as source of foreign exchange earnings for the Country (Mohammed-Lawal and Atte, 2006). Ozor (2009) identified the significant effects of climate change on crop production as; low crop yield, stunted growth, drying of seedling after germination, spread of pest and diseases, ineffective fertilizer application due to rainfall delay. Adefolalu (2007) reported that Nigeria is already being plagued with diverse ecological problems which have been directly linked to the on-going climate change Therefore, the resource poor farmers faced the prospects of tragic crop failure which reduced agricultural productivity, increased hunger, poverty, malnutrition and diseases (Zoellick *et al*., 2009, Obioha, 2008). Farmers in Nigeria are abandoning farming for non-framing activities due to these environmental threats resulting to declining in crop yields (Apata *et al*., 2010). Also, Obioha (2009) reported that sustainability of the

environment to provide all life support systems and the materials for fulfilling all developmental aspirations of man and animals is dependent on the suitability of the climate which is undergoing constant changes hence, posing a threat to food security in Nigeria. It is on this basis that this study is necessitated to find out what the farmers' perceived as the effects of climate change variability on their food production. The study was therefore designed to achieve the following objectives;

1. examine the socio-economic characteristics of the food crop farmers in the study area and their perceived effects of climate change;
2. determine the perceived effect of climate change on farmers' level of food crop production.

Hypotheses

The study tested the following hypotheses at the 0.05 level of significance:

Ho_1: There is no significant relationship between the socio-economic characteristics of the respondents and their perceived effects of climate change.

Ho_2: There is no significant relationship between farmers' perceived effects of climate change and their level of food crop production.

METHODOLOGY

The study was carried out in Edo and Ondo States of Nigeria. The population of the study comprises all food crop farmers in the study area. A multi-stage sampling procedure was used in selecting the respondents in this study. The first stage involved a purposive selection of two (2) States. The second stage involved a proportionate (1/6) sampling selection of three (3) local government areas out of 18 local government areas in each State. Hence, a total number of six (6) local government areas were selected in the two States. Local government areas with the highest production level were selected using the Agricultural Development Programme (ADP) data on production output of cassava, maize and rice in both states. The third stage involved random selection of four (4) communities from each of the LGAs and was identified through the help of ADP officers in both states. The last stage involved a purposive selection of ten (10) food crop farmers from each of the communities selected. The selection was based on farmers growing the three food crops namely cassava, maize and rice, given one hundred and twenty (120) respondents in each State and total number of two hundred and forty respondents for the research work. Both quantitative and qualitative methods of data collection were used in obtaining information from the selected respondents. The instrument for data collection was subjected to face and content validity. The reliability of the instrument was determined through the test-retest reliability method. Data collected were analysed using descriptive and inferential statistical tools. Farmers' perceived effects of climate change on their food production was operationalised by asking respondents to indicate their perceptions on some statements using a 5 point scale scored as follows: No effect = 0, little effect = 1, some effect = 2, high effect = 3 and very high effect = 4. The total scores were calculated as well as the means. Scores below the mean was categorized as low effect while equal to or above the mean was considered as high effect. Chi-square test and Pearson Product Moment Correlation (PPMC) were used to test for the hypotheses.

RESULTS AND DISCUSSION

Socio-Economic Characteristics of Respondents

The results in Table 1 reveals that the number of male respondents (73.8%) was higher than that of the female farmers (26.2%), which implies that more males were involved in food crop farming in the study area. This is in agreement with Osikabor *et al*. (2011) who indicated that male participates more than female in agricultural production. The mean age of the respondents was 49.6 years, which means most of the respondents were middle-aged and could therefore be still active. This agrees with that of Adejare & Arimi (2013) who reported that majority of the agricultural labour force in Nigeria falls within 35 – 50 years. The majority (85.4%) of the respondents were married. Adebayo *et al*. (2008) posited that more married persons are involved in farming. The study reveals that only 11.7% had no formal education hence indicates a high level of literacy among respondents and this could have implications for agricultural production. According to Allison *et al*. (2009), vulnerability and adaptation of a nation to climate change impact depends on level of education of its citizens. The mean household size of the respondents was approximately seven persons. This implies a moderate household size. According to Kayunze (2000), large household size is an important asset in working together to reduce vulnerability to the effects of climate change. The mean farming experience of the respondents was approximately twelve years which implies that most farmers are relatively young in the farming business. Adesina & Zinnah (1993) postulated that younger farmers have greater tendencies to improve and adapt to new technologies because they are relatively more knowledgeable, more open to risk taking and have longer planning horizons than their older counterpart.

Table 1 Distribution of Respondents' Socio-Economic Characteristics

Variables	Frequency(n=240)	Percentage (%)	Mean
Sex			
Female	63	26.2	
Male	177	73.8	
Age (years)			49.6
30 years and below	10	4.2	
31-40	35	14.6	
41-50	86	35.8	
Above 50 years	109	45.4	
Marital status			
Single	12	5.0	
Married	205	85.4	
Widowed	21	8.8	
Divorced	1	0.4	
Separated	1	0.4	
Educational Level			
No formal education	28	11.7	
Attempted primary school	17	7.1	
Completed primary school	46	19.2	
Attempted secondary school	26	10.8	
Completed secondary school	88	36.7	
Attempted tertiary school	9	3.7	
Completed tertiary school	36	10.8	
Household size			7
1-3	8	3.3	
4-6	111	46.3	
7-9	89	37.1	
≥ 10	32	13.3	
Farming experience (years)			12.3
$\leq$ 10 years	51	21.3	
11-20	93	38.7	
>20	96	40.0	

Source: Field Survey, 2018

Average Farm Output of Respondents in Tonnes

Table 2 reveals the output of the respondents in the study area. For cassava production, the mean output in the year 2014 was 13.68 tonnes (tons) while, the mean output for the year 2015 and 2016 were 19.62 tons and 23.96 tons respectively, while the average cassava output was 19.09 tonnes. Average cassava output per hectares was 15.38 tonnes per hectare; this implies that farmers were still producing below the potential yield of 25 tonnes per hectare hence output level is relatively low. This support the study of Afolabi *et al.* (2015) who indicated that cassava farmers in Nigeria are still producing below the potential yield of 25 tonnes per hectare. The results supported Oyekanmi and Okeleye (2007) which reported that cassava yield per hectare is 15.12 tonnes/hectare (tons/ha) in rainforest and 11.21 tons/ha in savannah zones. For maize production, the mean outputs were 2.65 tonnes, 2.61 tonnes, and 2.89 tonnes for three consecutive years, while the average maize output was 2.72 tonnes. The average maize output per hectares for three consecutive years (between 2014 to 2016) was 2.97 tons/ha. The output level is considered to be low when compared to Thailand whose output level was over 4.2 tons/ha. For rice production, the mean outputs were 5.44 tonnes, 4.48 tonnes, and 4.99 tonnes for three consecutive years (2014 to 2016). The average rice output was 4.97 tonnes. The average rice output per hectares for three consecutive years (between 2014 to 2016) was 5.62 tons/ha. The output is reasonably high, which negate the findings of Ekeleme *et al*. (2008) which indicated that average rice output (yield) in Nigeria is low and ranges between 1 and 2.5 tonnes/ha, while Okeleye *et al*. (2012) posited that rice yield in most developing is as low as 0.5 tonnes/ha.

Table 2: Average Output in Tonnes

Crop	Output in tonnes ('000kg)			Average output in tonnes	Average output in tonnes per hectare
	2014	2015	2016		
Cassava	13.68	19.62	23.96	19.09	15.38
Maize	2.65	2.61	2.89	2.72	2.97
Rice	5.44	4.48	4.99	4.97	5.62

Source: Field Survey, 2018

Production Level by Respondents

As shown in Table 3, the study revealed that 91.7% of the cassava farmers were producing at high level of production while 8.3% were producing at low level of production. With maize production, the production level was considered to be very low with 96.7% of the farmers while a fragment of 3.3% had a high level of production. For rice production, the production level was considered to be reasonably high with 87.1% of the respondents producing at a high level while 12.9% had a low level production output.

Table 3: Production Level of Respondents

Crop	Average output in tonnes	Level of production	Frequency	Percentage	Decision
Cassava	19.09	> 19.09	220	91.7	High
		≤ 19.09	20	8.3	Low
Maize	2.72	> 2.72	8	3.3	High
		≤ 2.72	232	96.7	Low
Rice	4.97	> 4.97	209	87.1	High
		≤ 4.97	31	12.9	Low

Source: Field Survey, 2018

Perceived Effects of Climate Change on Respondents Food crop production

Table 4 shows the intensity of the perceived effects of climate change on respondents' food production from the perceived effects of farmers in the study area. The respondents perceived climate change had a high effect on the following: soil fertility ($\bar{x}$ = 2.90) as the soil fertility was declining, increased the use of agrochemicals ($\bar{x}$ = 3.00), decline in crop yield ($\bar{x}$ = 3.07), high stunted growth ($\bar{x}$ = 2.92), high increase in the cost of producing food crop ($\bar{x}$ = 3.25). The result revealed mean value is high, which implies that these effects of climate change were perceived as having high effect. While they perceived low effects on increase in the rate of weed infestation ($\bar{x}$ = 2.76), disease/pest infestation ($\bar{x}$ = 2.89), declining in farm income ($\bar{x}$ = 2.87), high food shortage ($\bar{x}$ = 2.82) and increase need for irrigation ($\bar{x}$ = 2.76). This finding agree with the work of Adegnandjou *et al*. (2018), established that 89% of the respondents in the study area perceived reduction in farm yield, high rate of diseases and pest infestation (85%), high cost of food products (90%).

Okunlola *et al*. (2018), in his own assertion said farmers were affected by increased use of agrochemicals in farms ($\bar{x}$ = 2.8), increase in soil depletion ($\bar{x}$ = 2.9), increased pest and diseases infestation on farms ($\bar{x}$ = 3.0) declining farm income ($\bar{x}$ = 2.8) and decrease in farm output ($\bar{x}$ = 2.8).

Table 4: Distribution of Respondents According to their Perceived Effects of Climate Change on their Food Crop Production

Effects	Very High Effect	High Effect	Some Effect	Little Effects	No Effect	Mean	Decision	Rank
Decline in soil fertility	59(24.6)	128(53.3)	26(10.8)	25(10.4)	2(0.8)	2.90	High	5
Increase use of agrochemicals	59(24.6)	135(57.9)	27(11.3)	14(5.8)	1(0.4)	3.00	High	3
Increased need for irrigation	43(17.9)	108(45.0)	38(15.8)	13(5.4)	38(15.8)	2.44	Low	10
Increase rate of weed infestation	46(19.2)	134(55.8)	22(9.2)	32(13.3)	6(2.5)	2.76	Low	9
High rate of disease/pest infection	60(25.0)	125(52.1)	18(7.5)	37(15.4)	----	2.87	Low	6
Decline in crop yield	58(24.2)	150(62.5)	23(9.6)	8(3.3)	1(0.4)	3.07	High	2
Declining farm income	66(27.5)	118(49.2)	15(6.3)	40(16.7)	1(0.4)	2.87	Low	7
High food shortage	55(22.9)	127(52.9)	20(8.3)	35(14.6)	3(1.3)	2.82	Low	8
High stunted growth	46(19.2)	145(60.4)	35(14.6)	12(5.0)	2(0.8)	2.92	High	4
High cost of food crop production	78(32.5)	147(66.3)	13(5.4)	1(0.4)	1(0.4)	3.25	High	1
Grand mean						2.89		

Source: Field Survey, 2018

Test of Hypotheses

Ho_1: There is no significant relationship between the socio-economic characteristics of the respondents and their perceived effects of climate change. The result of Chi-square test presented in Table 5 showed that none of the socio-economic characteristics under consideration such as sex (χ^2= 4.56, *P* = 0.10); marital status (χ^2 = 4.10, *P* = 0.85); religion (χ^2= 1.52, *P* = 0.82); educational level (χ^2 = 15.49, *P* = 0.22) were significant at 0.05 level of significance, hence none of these personal characteristics affect their perception of the effects of climate change. The null hypothesis was therefore accepted. The study agreed with Mustapha (2012) which established that sex and marital status do not influence the farmers' perceived effects of climate change.

Table 5: Chi-Square Analysis of Socio-economic Characteristics and their Perceived Effects of Climate Change

Socio economic Characteristics	Calculated χ^2	Df	P-value	Decision
Sex	4.56	2	0.10	Not significant
Marital status	4.10	8	0.85	Not significant
Religion	1.52	4	0.82	Not significant
Educational level	15.49	12	0.22	Not significant

Source: Field Survey, 2018 Level of significance = 0.05

Table 6 further reveals the result of correlation between socio economic characteristics and their perceived effects of climate change. The table reveals that the age of farmers had a negative and significant relationship with the perceived effects of climate change (r = -0.16, *P* = 0.02) at *P*< 0.05 level. This implies that, young farmers have higher perception of the effects of climate change than older farmers. This negative sign of age was contrary to a priori expectation that older farmers are more likely to perceive climate effects compared to the younger counterpart. Also, there is a negative and significant relationship between farming experience (r = -0.35, *P* = 0.00) and perceived effects of climate change. This implies that, the higher the numbers of years of experience of farmers, the lower their perception of the effects of climate change and vice-versa. Thus older farmers have been adjusting and adapting while the younger farmers are feeling the climate change more. There is a positive and significant relationship between household size (r = 0.13, *P* = 0.05) and perceived effects of climate change. There is a negative and significant relationship between perceived effects of climate change and maize average farm size (r = -0.50, *P* = 0.00) as well as cassava average farm size (r = -0.38, *P* = 0.00) respectively. This means the bigger the farm size the lower the farmers' perceived effects of climate change because farmers' with bigger farm size were less likely to perceive the effects of climate change compared with those with smaller farm size. The perceived effects of climate change are thus more pronounced on small scale farmers as any little change is seriously reflected on their small plots. The results is an indication that an increase in the level of these variables (age, farming experience, farm size for both cassava and rice) would lead to a decrease in the level of farmers' perceived effects of climate change, while an increase in household size would definitely increase farmers' perceived effects of climate change. In addition, average rice farm size was not significantly associated with the perceived effects of climate change. Also, the study of Ofuoku (2011) posited that farm size and farming experience were statistically and positively correlated with the perceived effects of climate change among farmers in Delta state. Mustapha (2012) in his study agreed that age, farm size, educational level and farming experience were significant with the level of farmers' perception on climate change. Ayanwuyi *et al*. (2010) posited that years of farming experience is positively significant to perception of climate change while Owolabi *et al*. (2015) posited that sex, marital status and educational status have a significant influence with the farmers' perception of climate change by rice farmers in Ekiti State.

Table 6: Result of Correlation Analysis between Socio Economic Characteristics of Respondents and their Perceived Effects of Climate Change on their Food Production

Socio economic Characteristics	Correlation (r-value)	P – value	Decision
Age	-0.16	0.02	S
Year of formal education	-0.02	0.91	NS
Household size	0.13	0.05	S
Farming experience	-0.35	0.00	S
Average farm size (cassava)	-0.38	0.00	S
Average farm size (maize)	-0.50	0.00	S
Average farm size (rice)	-0.03	0.68	NS

Source: Field Survey (2018)

Ho_2: There is no significant relationship between farmers' perceived effects of climate change and their level of food crop production

The result in Table 7 shows the correlation analysis of the relationship between production level of respondents and their perceived effects of climate change. The result revealed that both the average cassava output (r = 0.23, *P* = 0.00) and average rice output production (r = -0.19, *P* = 0.00) are significantly related to perceived effects of climate change at 0.05 level of significance. The level of maize production however had no significant relationship with the perceived effects of climate change. The average output of rice had a negative and significant relationship (inverse) with perceived effects of climate change in the study area. This implies that output from rice production decreases with more effects of climate change as perceived on their production. Hence, the result is an indication that climate change affects rice production negatively. This finding is corroborated by Onyegbula (2017) who indicated an inverse relationship between perceived effects of climate change and farmers' rice productivity. Furthermore, the perceived effects of climate change by farmers with cassava production was found to have a positive and significant relationship (*P*< 0.01) with the average cassava output level. This implies that the higher their perception on effects of climate change; the higher the output realized from cassava production in the study area. This might be because the higher the perceived effects of climate change on cassava production, the more readily the farmers would adopt adaptation strategies to checkmate or curtail the effects of climate change. Moreover cassava is a hardy crop that is tolerant to adverse climatic and production condition, so it tends to thrive in inhibiting environment.

Table 7: Results of Correlation Analysis of the Relationship between Production Level of Respondents and their Perceived Effects of Climate Change.

Output	Correlation r-value	P value	Decision
Average maize output	**0.00**	**0.95**	**NS**
Average cassava output	**0.23**	**0.00**	**S**
Average rice output	**-0.19**	**0.00**	**S**

Source: Field Survey, 2018

CONCLUSION

Majority of the farmers were more adequately aware of the perceived effects of climate change on food crop production

RECOMMENDATION

The study recommended that there is need for appropriate stakeholders to provide farmers with necessary input in order to reduce adverse effects of climate change on their food crop production.

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