NIGERIAN AGRICULTURAL JOURNAL
ISSN: 0300-368X
Volume 52 Number 3, December 2021 Pg. 369-373
Available online at: http://www.ajol.info/index.php/naj
https://www.naj.asn.org.ng

EFFECT OF CLIMATE CHANGE MITIGATING PRACTICES ON THE PRODUCTIVITY OF ARABLE CROP FARMERS IN ABIA STATE, NIGERIA

Okpara, B. O., Obasi, I.O. and Nwaogu, D.C.
Department of Agricultural Economics, Michael Okpara University of Agriculture, Umudike, Abia State
Corresponding Author's email: beatriceokpara@gmail.com

Abstract
Agricultural production in Nigeria is heavily dependent on changes in climate over time. Farmers have identified and tried to manage such changes. This study therefore examined the effect of climate change mitigation practices on the productivity of arable crops farmers in Abia State, Nigeria. Data were elicited from 180 farmers (purposively selected) comprising of adopters and non-adopters of climate change mitigation practices drawn from the study population, while, descriptive statistics and regression techniques were used to analyze the data. The result showed that the use of organic manure and improved agricultural seedlings were the most adopted mitigation practices, while, thinning, zero tillage and zero bush burning were the least adopted. Adoption was expected as hypothesized to positively influence productivity as the productivity index of adopters (1.72) was higher than that of non-adopters (1.39), implying that applying climate change mitigation practices guarantee higher farm productivity. Farmers' age, years in school, farm size, household size, and farming experience were the significant factors that affected productivity for adopters and age and years in school for non-adopters. There was a significant difference in the productivity of adopters and non- adopters. Based on the research, it was recommended that government should formulate and implement viable polices geared towards effectively mitigating the harsh effect of climate variability and effective extension of these practices to farmers.

Keywords: climate change, mitigation practices, adopters, productivity

Introduction

Agriculture which is one of the oldest economic activities in the world gainfully employs over 70% of the world's population (IPCC, 2007). Farming in Nigeria is highly dependent on weather and climate in order to produce the food and fibre necessary to sustain human life. This is expected to lead to climate change vulnerability and susceptibility to resultant changes. Agricultural production in Nigeria depends on the weather conditional changes in climate and climate trend often has a direct influence on the quantity and quality of agricultural production in Nigeria. Therefore, food shortage is linked with climate change. Climate change in 21st century is bringing a new set of weather patterns and extremes that are well beyond what sub-Saharan communities are capable of dealing with, especially when coupled with the many non-climatic constraints that undermine the adaptive capacity of these communities (UNDP, 2009). Agricultural production, including access to food (food security), in many African countries and regions is projected to be severely compromised by climate variability and change. About 75% of the projected most affected people reside in rural areas of developing countries, their livelihoods depending directly or indirectly on agriculture (FAO, 2009). As key economic sector of most low income developing countries, improving the resilience of agricultural systems is essential for climate change adaption (Adger *et al.,* 2003). In Africa, taking Nigeria as an example, information about climate change is poor, technological change has been the slowest and the domestic economies depend heavily on agriculture (Action Aid, 2008). Nigeria has a population of 150m– the largest in Africa and a fast growing economy, yet it is a food deficit nation and imports large amounts of grain, livestock products and fish (IFAD, 2009). As the population grows and puts pressure on dwindling resources, increased environmental problems threaten food production. Nigeria is confronted by major environmental problems and every country that is vulnerable to climate change (Obioha, 2008) and the agricultural sector is under this threat. Strengthening agricultural production systems is a fundamental means of improving incomes and food security for the largest group of food insecure in the world (World Bank, 2007). It is very evident that the world is currently facing a complex set of challenges from climate change, while agricultural sectors in temperate and polar countries may appear to benefit from the change, especially in Nigeria and other African countries more vulnerable to the change. However, effects of climate change on Nigerian agriculture are expected to differ across the agro-ecological zones. Climate change problem is adjudged to be severe in African Countries, including Nigeria because current level of knowledge and information is poor, technological change has been the slowest, while the domestic economies depend heavily on agriculture. The implications of climate change for the attainment of millennium Development Goals whose prime is to eradicate extreme poverty and hunger, especially in developing countries where resilience is low, are obvious. Change in the agricultural sector is essential to mitigate climate change, ensure food security for the growing population, and improve the livelihoods of poor smallholder producers. This paper examines the effect of climate change mitigation practices on the productivity of arable crops among small scale farmers in Isiala Ngwa North of Abia State in Nigeria.

Methodology

The study was conducted in Abia State Nigeria. The state has three agricultural zones namely: Ohafia, Umuahia and Aba and 17 Local Government Areas (LGA). Abia State is located in the tropical rainforest zone of Nigeria. The climate is consistently hot with maxima typically being about 31°C and minima around 24°C with evenly distributed rainfall in moderate manner. It is low-lying with a heavy rainfall of about 2400mm yearly, especially intense between the months of April through October. The State covers a Land area of 5,243.7 square kilometers. It has a total population of 2,845,380 comprising of 1,430,298 male and 1,415,082 females (NPC, 2006). It is estimated that about 70% of this population live in rural areas. Primary data were obtained through questionnaires and personal interviews. Two (2) LGAs were selected followed by the selection of two (2) autonomous communities from each LGA. Three villages were selected from each of the autonomous communities, while fifteen (15) farmers were selected from each village to have a total of 180 farmers. Simple descriptive statistical tools, productivity index, regression and Z-test models were employed in the data analyses.

Productivity index (Y) is given as:

$$Y = \frac{\text{Total output } (₦)}{\text{Total input } (₦)} \text{……} \ (1)$$

The regression model is implicitly stated thus;

$Y= f(x_1, X_2, X_3, X_4, X_5, X_6, X_7)$ ……. (2)

Where,

Y = Productivity index

X_1= Age of farmers (years)

X_2= Gender of farmers (1 if male, 0 if female)

X_3= Level of education in years

X_4= Farm size (Ha)

X_5= Household size

X_6= Labour cost (N)

X_7=Farming experience in years

To test the effect of adopting mitigation practices on farm productivity, a Z-test is performed on the two farmers' categories (those who adopt and do not adopt mitigation practices). The Z-test is stated as follows:

$$Z_{cal} = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S^2\bar{X}_1}{n_1} + \frac{S^2\bar{X}_2}{n_2}}} \text{………} \ (3)$$

Where;

X_1 = mean productivity of farmers adopting mitigation practices

X_2 = mean productivity of farmers not adopting mitigation practices

$S^2\bar{X}_1$ = variance of farmers adopting mitigation practices

$S^2\bar{X}_2$ = variance of farmers not adopting mitigation practices

n_1 = number of farmers adopting mitigation practices

n_2 = number of farmers not adopting mitigation practices

Results and Discussion

Table 1 gives a breakdown of the various types of climate change mitigation practices adopted by the farmers. They include; crop rotation (which ranked highest in the study area), shifting cultivation, mulching, and bush fallow and others. The use of organic manure and improved agricultural seedlings were fairly practiced, while, thinning, zero tillage and zero bush burning were poorly practiced. The productivity of farmers were not maximized because practices that add value to the productivity of the soil like use of improved seedling, zero tillage and zero bush burning were not efficiently practiced. This result agrees with the findings of Edoka (2010).Table 2 showed the productivity index of adopters and non- adopters of climate change mitigation practices. It indicates that the productivity index of adopters (1.72) was higher than the productivity index of non-adopters (1.39). This result is as expected and therefore implies that applying climate change mitigation practices increases farm productivity and consequently farm incomes due to increased output.Table 3 shows the regression result of factors that influenced productivity for adopters. From the functional forms tried, the double-log form was chosen as the lead equation based on the number of significant variables, F-ratio, highest R^2 value and magnitude of variable as they conform to *a priori* expectations. The R^2 value of 0.983 implies that about 98.3% changes in the productivity of adopters was accounted for by the variables in the model, while the remaining 3% was accounted to error. The significant variables in the model influencing productivity of the farmers were age, years in school, farm size, household size and farming experience. The coefficient of age was negative and significant at 5%, implying that productivity declines with increase in age. This result corroborates the finding of Ukoha *et al*. (2010). The coefficient of years in school was negative and significant at 5%, implying that farmers with more years spent in school had less farm productivity than farmers with less education. This does not conform to *a priori* expectation because education is expected to encourage the acceptance of innovations and better production techniques and as such, educated farmers are expected to have higher farm productivity than uneducated farmers. However, a deviation might have arisen due to the fact that with an additional educational qualification, farmers tend to leave agriculture for more lucrative white collar jobs. Ibro (2008) is in tandem with this position. The coefficient of farm size was positive and significant at 1%. It implies that as expected, the higher the farm size, the higher the productivity and agrees with the findings of Madu *et al*. (2008). The coefficient of household size was positive and significant at 1%. The result reveals that higher household sizes led to higher productivity and as such, with an additional household member, there was an increase in the productivity of the farmers. This result is not in line with the study of Okoye *et al*. (2008) which identified a negative relationship between household size and farm productivity. According to the study, farmers with large household sizes tend to dissipate most of their resources on the upbringing and education of their children and there is also a high tendency to spend the resources on feeding other household dependents making it difficult to be more productive. The coefficient of farming experience was positive and significant at 5% showing that the higher number of years farmers spent farming, the more productive they are. This agrees with *a priori* expectation.Table 4 shows the regression result of factors influencing productivity for non-adopters. From the result obtained, the double log function was chosen as the lead equation based on the number of significant variables, F- ratio and value of R^2. The R^2 value of 0.630 implies that about 63% of the productivity of non-adopters was accounted for by the variables included in the model, while 37% remaining was accounted for by error. From the result obtained, the variables - age and years in school were the significant variables which influenced productivity of non-adopters. The coefficient of age was positive and significant at 10%. This implies that an increase in age for non-adopters led to an increase in their productivity. This result disagrees with economic theory as people produce more when they are younger than when they are advanced in age. The coefficient of years in school had a negative relationship with the productivity of non-adopters, implying that more years spent in school by non-adopters led to a decrease in productivity. This is not in line with the *a priori* expectation where more years in school should bring about an increase in productivity. Table 5 shows the mean difference between the productivity of farmers adopting the climate change mitigation practices and those not adopting. The productivity of adopters was higher than that of non–adopters in the study area. This may be attributed to the benefits derived from adopting mitigation practices.

Conclusion

The study was carried out to show the effect of climate change mitigation practices on the productivity of arable crops farmers in Abia State. Nigeria. The use of organic manure and improved agricultural seedlings were fairly practiced, while, thinning, zero tillage and zero bush burning were poorly practiced. The significant variables in the model influencing productivity of the farmers were age, years in school, farm size, household size and farming experience. Age and years in school were the significant variables which influenced the productivity of non-adopters. The productivity of adopters was higher than that of non–adopters in the study area. This may be attributed to the benefits derived from adopting mitigation practices. Based on the research, it was recommended that government formulate and implement viable polices geared towards effective mitigation and properly extended to farmers. The significant variables that influenced production must also be considered by policy makers in policy issues.

References

Adger, W.N., Hug, S., Brown, K., Conway, D. and Hulme, M (2003). Adapation to Climate change in th developing world. *Progress in Development Studies*, 3:179-195.

Edoka, M.H., Adejo, P.E. and Otitolaiye, J.O. (2010). Soil Fertility Management techniques among Rural Farmers in Olamaboro Local Government Area of Kogi State, Nigeria: A Lesson for Extension Service Providers. The Huddles. Proceedings of the 5th Annual Conference of the Nigerian Society of indigenous Knowledge and Development Held 3rd November - 6th November, 2010, in Yenegoa, Bayelsa State, Nigeria. Pp. 152-157.

FAO (2009). Food and Agriculture Organization. Food Security and Agriculture in Developing Countries: Optics for Capturing Synergies. Food and Agriculture Organization of the United Nations.Pp4-6

Ibro, J.D. (2008). A study of Cowpea Value Chain in Kano State, Nigeria from Gender Perspective, USAID P.10

IFAD (2009). "Enabling rural poor people to overcome poverty in Nigeria" July, 2009, P.8.

IPCC (2007). Agriculture in Climate Change 2007; Mitigation. Working Group III Contributing to the Fourth Assessment Report of the IPCC. Cambridge: Cambridge University Press.40(1), p.9

Madu, T.U., Anyaegbunam, H.N. and Okoye, B.C. (2008). Empirical Analysis of Determinants of Productivity among Small holder Cassava Farmers in Abia State, Nigeria. National Root Crops Research Institute, Umudike, Umuahia, Abia State, Nigeria. August, 2008. Munich Personal RePEc Archive, 35(3) P. 6

NPC (2006). National Population Commission. Nigerian Agricultural Magazine. 4 (3).

Obioha, E. (2008). Climate Change, Population Drift and Violent Conflict over land resources in North Eastern Nigeria. *Journal of Human Ecology,* 23(4): 311 – 324.

Okoye, B.C., Onyenweaku, C.E. and Agwu, A.E. (2008) Technical Efficiency of Small-Holder Cocoyam Farmers in Anambra State, Nigeria: Implications for Agricultural Extension Policy. *Journal of Agricultural Extension,* 12(1):107-116

Ukoha, O.O., Okoye, B.C. and Emetu, J. (2010). Analysis of the Determinants of Total Factor Productivity among Small-Holder Cassava Farmers in Oha_a L.G.A of Abia State. *Munich Personal RePEc Archive.vol(3) 115-119.*

UNDP (2009). United Nations Development Programme. Resource Guide on Gender and Climate Change <http://content.undp.org/go/cmservice/download/assest/

World Bank (2007). Agriculture for development: World Development Report 2008. Washington, DC: The World Bank.

Table 1: Distribution of respondent according to climate change practices

Mitigation practices	Percentage (%)
Crop rotation	50
Shifting cultivation	48
Molding	42
Bush fallowing	47
Use of organic manure	20
Zero tillage	15
Thinning	7
Zero bush burning	12
Improved agricultural seedling	25

Source: Field survey, 2017

Table 2: Productivity of arable crops for adopters and non-adopters

Total input cost	Adopter value (₦)	Non-adopters value (₦)
Transportation	744000	712600
Seedling cost	712000	711000
Fertilizer cost	672000	681600
Pesticide cost	375600	285500
Labour cost	1709300	2052500
Depreciation	98460	96768
Total	**4361360**	**4539968**
Total return (output)	**7509438**	**6334750**
Productivity	**1.722**	**1.395**

Source: Field survey, 2017

Table 3: Regression result of factors influencing the productivity for adopters

Variables	Linear	Semi-log	Double-log+	Exponential
Constant	-38054.078	462204.006	15.293	9.350
	(-1.619*)	(1.574*)	(5.808***)	(25.069***)
X_1 (Age in years)	45.771	-133244.643	-1.426	-.006
	(.067)	(-1.925*)	(-2.299**)	(-.527)
X_2 (Sex)	9305.271	.004	40.621	.179
	(1.306)	(.487)	(.043)	(1.579*)
X_3 (Years in school)	-1741.005	-17833.456	-.404	-.028
	(-.1.790*)	(-.962)	(-2.430**)	(-1.836*)
X_4 (Farm size in hectare)	13379.731	94173.008	1.430	2.126
	(3.564***)	(3.118***)	(4.212***)	(2.001**)
X_5 (Household size)	1096.882	52587.477	.621	.045
	(.458)	(2.028**)	(2.673***)	(1.194)
X_6 (Labour cost in naira)	.684	-797.639	.065	7.501E-006
	(3.138***)	(-.068)	(.618)	(2.168**)
X_7(Farming experience)	1570.900	61747.765	.0598	.028
	(1.343)	(2.218**)	(2.398**)	(1.526*)
R^2	**.904**	**.960**	**.983**	**.907**
R^2 adjusted	**.874**	**.880**	**.950**	**.877**
F-ratio	**29.618*** **	**12.017*** **	**29.567*** **	**30.580*** **

Source: Field survey, 2017

(*): Significant at 10% level, (**): Significant at 5% level, (***): Significant at 1% level Figures in parenthesis are t-ratios

Table 4: Regression result of factors influencing the productivity for non-adopters

Variables	Linear	Semi-log	Double-log+	Exponential
Constant	-59281.1863 (-1.655*)	-798161.175 (-.507)	9.178 (.364)	9.014 (15.351***)
X_1 (Age in years)	-630.314 (1.003)	196318.292 (1.136)	4.292 (1.550*)	.007 (.524)
X_2 (Sex)	2290.058 (0.213)	0.08 (.546)	0.04 (.400)	.021 (.119)
X_3 (Years in school)	-4165.839 (-1.475)	45814.555 (-.997)	-.867 (-.672)	-.031 (-.672)
X_4 (Farm size in hectare)	62121.681 (-1.293)	0.10 (.620)	8.112 (.354)	-.808 (-1.027)
X_5 (Household size)	76.728 (-.60)	-308611.501 (-1.725*)	-5.852 (-2.041**)	-.002 (-.072)
X_6 (Labour cost in naira)	423.067 (0.338)	-36521.201 (-.361)	-1.257 (-.776)	.005 (.259)
R^2	**.624**	**.638**	**.630**	**.574**
R^2 adjusted	**.505**	**.527**	**.579**	**.439**
F-ratio	**5.226*****	**3.020*****	**2.647*****	**4.237*****

Source: Field survey, 2017

(*): Significant at 10% level, (**): Significant at 5% level, (***): Significant at 1% level

Figures in parenthesis are t-ratios

Table 5: Statistical difference between the productivity of adopters and non-adopters

	N	Mean	Std. Deviation	Std. Error Mean	z	df
Adopters	150	1.722	899.725	.401	10.431	119
Non adopters	90	1.395	407.674	.478	8.430	119
Difference		0.327	492.051	-.077	2.001**	

Source: Field survey, 2017