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Climate Smart Agricultural Practices For Improving Arable Crop Production In Ohaozara Local Government Area Of Ebonyi State

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***Abstract:** The study was carried out to examine the climate smart agricultural practices for improving arable crop production in Ohaozara Local Government Area of Ebonyi State. The study was guided by three research questions and three hypotheses. The study adopted descriptive survey research design. The population of the study was 257 comprising 16 extension agents and 241 registered crop farmers. The sample of the study was 66 comprising 56 crop farmers and 10 extension agents using purposive sampling technique. The instrument for data collection was questionnaire validated by three experts from the Department of Agricultural and Vocational Education, Michael Okpara University of Agriculture, Umudike. The reliability of the instrument was determined using Cronbach Alpha Statistics that yielded 0.72 reliability coefficient index. The data collected were analysed using mean and standard deviation to answer the research questions. While the hypotheses were tested using t-test statistic at 0.05 level of significance. The result of the data analyses revealed that the climate smart practices adopted by the farmers include: integrated soil fertility management, crop rotation practice. Meanwhile, challenges of farmers and adoption of climate smart agricultural practices for improving arable crop production include: limited access to farmland. Inadequate access to agricultural input and financial constraints among others. Based on the findings, it was recommended that extension agents in Ebonyi State should be continuously trained and educated on current information about climate change and smart agricultural practices and sent out to enlighten the farmers.*

***Keywords:** Climate Smart, Arable Crops, Climate Change, Agricultural Practices and production.*

I. INTRODUCTION

Climate change is the worldwide environmental threats that seriously affect agricultural productivity and it affects mankind in numerous ways, including its direct influence on food production (crop and animal production). Even though the climate change is global, developing countries like Nigeria and Ebonyi State in particular are the most adversely affected by climate change due to their low level of adaptive capabilities (Ozor, 2019).Climate is the average weather condition of a place taken over a prolonged period of time (American Meteorological Society, AMS, 2017). It is the statistics of temperature, humidity, pressure, wind, rainfall, sunshine intensity and other meteorological elemental measurements in a given area over a long period of time, usually 30years and above (Intergovernmental Panel on Climate Change, IPCC, 2017).

It is therefore necessary to device a strategic means of achieving a sustainable agricultural development for food security against the influence of climate change without causing depletion to the natural state of the soil (Ogundele & Jegede, 2013).One of such interventions is climate-smart agricultural practices. It is not a new agricultural system but a new approach, a way to guide the needed changes of agricultural systems particularly to address food security and climate challenges.

Crop production is vulnerable to climate variability and climate change associated with increases in temperature, increases in CO2, and changing patterns of rainfall leading to a considerable decline in crop production. As temperature increases and rainfall pattern becomes more unpredictable, crop yields drop significantly. Also extreme weather events such as thunderstorms, heavy winds and floods devastate farmlands and can lead to crop failure. Pests and diseases migrate in response to climate changes and variations (Ozor, 2019).Climate change is one of the most serious environmental threats facing agricultural production worldwide especially the arable crop production (Ikehi & Zimoghen, 2014).

Production of arable crops remains an important part of all farming enterprise in Nigeria agricultural sub-section with divers arable crops like cassava, yam, maize, rice, sorghum, millet, cowpea, soybean, groundnut, potatoes, cocoyam, tomato, pepper, okro among others. These crops can be classified as cereals, legumes, root and tuber crops, and horticultural crops. They differ in soil and nutrient requirements (Adewumi, Tanko, Ibrahim & Yisa, 2019).

These arable crops are vulnerable to climate change which affects their productivity. It is therefore necessary to device a strategic means of achieving a sustainable agricultural development for food security against the influence of climate change without causing depletion to the natural state of the soil (Nwosu, 2015). One such intervention is climate-smart agricultural practices. Climate smart agricultural (CSA) practices are the innovative indigenous and technological practices that are relevant for improve crop production (Igberi, Osuji, Odo, Ibekwe, Onyemauwa, Obi, Obike, Obasi, Ifejimalu, Ebe, Ibeagwa, Chinaka, Emeka, Orji & Ibrahim-Olesin, 2022).

According to Khatri-Chhetri, Aggarwal and Joshi (2017) climate smart agricultural practices tends to improve crop yields, increase agricultural productivity, enhance farmers' resilience, ensure food security, increase farmer income through crop rotation practice, seed treatment, tree planting, soil conservation. Consequently, according to Igberi, *et al.*, (2022) adoption of climate smart agricultural practices by farmers are limited by different factors such as adequate knowledge of the farmers on climate smart agricultural practices and lack of extension information among others. To this end the study sought to examine climate smart agricultural practices for improving arable crop production in Ohaozara Local Government Area of Ebonyi State.

PURPOSE OF THE STUDY

The purpose of the study is to examine the climate smart agricultural practices for improving arable crop production in Ohaozara Local Government Area of Ebonyi State.

Specifically, the study seeks to:

- ✓ Find out climate smart agricultural practices used by farmers for improving arable crop production in Ohaozara Local Government Area.
- ✓ Determine the challenges of farmers' adoption of climate smart agricultural practices for improving arable crop production in Ohaozara Local Government Area.
- ✓ Examine the mechanisms for enhancing farmers' use of climate smart agricultural practices for improving arable crop production in Ohaozara Local Government Area.

RESEARCH QUESTIONS

The following research questions were posed to guide the study:

- ✓ What are the climate smart agricultural practices used by farmers for improving arable crop production in Ohaozara Local Government Area?
- ✓ What are the challenges of farmers' adoption of climate smart agricultural practices for improving arable crop production in Ohaozara Local Government?
- ✓ Examine the mechanisms for enhancing farmers' use of climate smart agricultural practices for improving arable crop production in Ohaozara Local Government Area?

HYPOTHESES

The following null hypotheses were formulated that guided the study and tested at 0.05 level of significance.

$H0_1$: There is no significant difference between the mean ratings of farmers and extension agents on climate smart agricultural practices used by farmers for improving arable crop production in Ohaozara Local Government Area.

$H0_2$: There is no significant difference between the mean ratings of farmers and extension agents on the challenges of farmers' adoption of climate smart agricultural practices for improving arable crop production in Ohaozara Local Government.

$H0_3$: There is no significant difference between the mean ratings of farmers and extension agents on the mechanisms for enhancing farmers' use of climate smart agricultural practices for improving arable crop production in Ohaozara Local Government Area.

II. METHODOLOGY

The study adopted descriptive survey research design. This design is the type of research design that describes what exists or the present status of existence where a group of individuals' or items is studied by collecting data through questionnaire or interview and analysing the data to establish fact (Nkwocha & Akanwa, 2017).The design was considered suitable for this study since the researcher made used of questionnaire to collect data from the respondents. The study was conducted in Ohaozara Local Government Area of Ebonyi State. The population of the study was 257 comprising 16 extension agents and 241 registered crop farmers in Ohaozara Local Government Area of Ebonyi State. The sample of 66 comprising 66 registered crop farmers and 10 extension agents was used in the study using purposive sampling technique. This technique is the type of sampling technique whereby the researcher relies on his personal judgement. The researcher use questionnaire instrument titled: "Climate Smart Agricultural Practices for Improving Arable Crop Production Questionnaire (CSAPIACPQ)". The questionnaire was designed by the researcher using four points rating scale of Strongly Agree (SA) 4, Agree (A) 3, Disagree (D) 2 and Strongly (SD) 1respectively. The instrument was validated by three experts from the Department of Agricultural and Vocational Education, Michael Okpara University of Agriculture, Umudike, the reliability of the instrument was determined using Cronbach Alpha Statistics that yielded 0.72 reliability coefficient index. The data collected were analysed using mean and standard deviation to answer the research questions. The mean cut-off benchmark of 2.50 and above was considered as agreed while below 2.50 was considered as disagreed. In addition the three hypotheses were tested using t-test statistic at 0.05 level of significance. For the hypotheses tested, when the t-calculated is less than t-critical, the hypothesis was accepted, but if the t-cal is greater than the t-critical (table value) the hypothesis was rejected.

III. RESULTS

The result of data analysed from research questions answered are presented in tables below.

Research Question 1: What are the climate smart agricultural practices used by farmers for improving arable crop production in Ohaozara Local Government Area?

S/N	ITEM STATEMENTS	$\bar{X}$	S.D	Rmks
1.	Planting of improved seed	2.84	1.08	Agreed
2.	Seed treatment	2.81	0.89	Agreed
3.	Use of pre-emergence herbicide	2.98	0.91	Agreed
4.	Avoidance of deforestation	2.98	0.97	Agreed
5.	Use of pesticide	3.00	1.04	Agreed
6.	Application of organic manure	3.09	0.95	Agreed
7.	Application of inorganic manure	2.87	1.03	Agreed
8.	Adoption of integrated soil fertility management	2.69	1.07	Agreed
9.	Crop rotation practice	2.85	0.99	Agreed
10.	Use of mulching	2.78	1.15	Agreed
	Cluster mean	**2.89**	**1.01**	

KEY: $\bar{X}$ = mean, S.D= Standard deviation, Rmks.= Remarks

Table 1: Mean and Standard Deviation of the Respondents' Responses on the Climate Smart Agricultural Practices Used by Farmers for Improving Arable Crop Production n=66

From the table 1 above, the means response of the respondents ranges from 2.69 to 3.09 which are all above the cut-off point of 2.50. This implies that the respondents agreed that all the items are the climate smart agricultural practices used by farmers for improving arable crop production. Also the standard deviation of all the items ranges from 0.89-1.15 which shows that the responses of the respondents are close to one another in their responses and that they were not far from the mean.

HYPOTHESIS ONE

$H0_1$: There is no significant difference between the mean ratings of farmers and extension agents on climate smart agricultural practices used by farmers for improving arable crop production in Ohaozara Local Government Area.

Variables	N	Mean	S.D	DF	t-cal.
Crop Farmers	56	2.95	0.93	64	0.28
Extension Agents	10	2.83	1.09		

Table 2: t-test Analysis of Mean Ratings of Farmers and Extension Agents on the Climate Smart Agricultural Practices Used by Farmers for Improving Arable Crop Production

The data in Table 4 above shows that the calculated t-value is 0.28 while the t- critical value is 1.98 at 0.05 level of significant and at 64 degree of freedom. Since the calculated value is less than the t-critical value, the null hypothesis was accepted. There is no significant difference between the mean ratings of farmers and extension agents on climate smart agricultural practices used by farmers for improving arable crop production. The null hypothesis is therefore accepted.

Research Question 2: What are the challenges of farmers' adoption of climate smart agricultural practices for improving arable crop production in Ohaozara Local Government?

S/N	ITEM STATEMENTS	$\bar{X}$	S.D	Rmks
1.	Limited access to farmland in terms of crop rotation	2.82	1.04	Agreed
2.	Inadequate access to agricultural input	2.79	1.10	Agreed
3.	Financial constraints	2.52	1.10	Agreed
4.	Lack of access to up to-date information	2.85	0.98	Agreed
5.	Inadequate government support to farmers	2.98	0.97	Agreed
6.	Inadequate knowledge of farmers on climate smart practices	2.83	0.83	Agreed
7.	High cost of agricultural inputs	3.97	0.55	Agreed
	Cluster Mean	**2.97**	**0.94**	

KEY: $\bar{X}$ = mean, S.D= Standard deviation, Rmks.= Remarks

Table 3: Mean and Standard Deviation of the Respondents' Responses on the Challenges of Farmers' Adoption of Climate Smart Agricultural Practices for Improving Arable Crop Production n=66

From the table 2 above, the means response of the respondents ranges from 2.52-3.97 which are all above the cut-off point of 2.50. This implies that the respondents agreed that all the items are the challenges of farmers' adoption of climate smart agricultural practices for improving arable crop production. Also the standard deviation of all the items ranges from 0.55-1.10 which shows that the responses of the respondents are close to one another in their responses and that they were not far from the mean.

$H0_2$: There is no significant difference between the mean ratings of farmers and extension agents on the challenges of farmers' adoption of climate smart agricultural practices for improving arable crop production in Ohaozara Local Government.

Variables	N	Mean	S.D	DF	t-cal.	t-crit.	Decision
Crop Farmers	56	3.08	0.90				
				64	0.56	1.98	Accepted
Extension Agents	10	2.86	0.98				

Table 4: t-test Analysis of Mean Ratings of Farmers and Extension Agents on the Farmers' Adoption of Climate Smart Agricultural Practices for Improving Arable Crop Production in Ohaozara Local Government Area

The data in Table 5 above shows that the calculated t-value is 0.56 while the t- critical value is 1.98 at 0.05 level of significant and at 64 degree of freedom. Since the calculated value is less than the t-critical value, the null hypothesis was accepted. There is no significant difference between the mean ratings of farmers and extension agents on the challenges of farmers' adoption of climate smart agricultural practices for improving arable crop production. The null hypothesis is therefore accepted.

Research Question 3: Examine the mechanisms for enhancing farmers' use ofclimate smart agricultural practices for improving arable crop production in Ohaozara Local Government Area

S/N	ITEM STATEMENTS	$\bar{X}$	S.D	Rmks
1.	Timely supply of agricultural input	2.61	1.04	Agreed
2.	Adequate farmers and extension linkage	2.67	1.00	Agreed
3.	Provision credit facilities to farmers	2.67	0.92	Agreed
4.	Provision of adequate information to farmers by extension agents	2.69	1.08	Agreed
5.	Inadequate government support to farmers	2.99	0.83	Agreed
6.	Farmers education on climate smart practices	2.93	0.86	Agreed
7.	Provision of subsidy to farmers on agricultural inputs	2.63	1.03	Agreed
	Cluster Mean	**2.74**	**0.96**	

KEY: $\bar{X}$ = mean, S.D= Standard deviation, Rmks.= Remarks.

Table 5: Mean and Standard Deviation of the Respondents' Responses on the Mechanisms for Enhancing Farmers' Use of Climate Smart Agricultural Practices for Improving Arable Crop Production n=66

From the table 3 above, the means response of the respondents ranges from 2.61-2.99 which are all above the cut-off point of 2.50. This implies that the respondents agreed that all the items are the mechanisms for enhancing farmers' use of climate smart agricultural practices for improving arable crop production. Also the standard deviation of all the items ranges from 0.83-1.08 which shows that the responses of the respondents are close to one another in their responses and that they were not far from the mean.

$H0_3$: There is no significant difference between the mean ratings of farmers and extension agents on the mechanisms for enhancing farmers' use of climate smart agricultural practices for improving arable crop production in Ohaozara Local Government Area.

Variables	N	Mean	S.D	DF	t-cal.	t-crit.	Decision
Crop Farmers	56	2.80	0.89				
				64	0.29	1.98	Accepted
Extension Agents	10	2.68	1.03				

Table 6: t-test Analysis of Mean Ratings of Farmers and Extension Agents on the Mechanisms for Enhancing Farmers' Use of Climate Smart Agricultural Practices for Improving Arable Crop Production

The data in Table 6 above shows that the calculated t-value is 0.29 while the t- critical value is 1.98 at 0.05 level of significant and at 61 degree of freedom. Since the calculated value is less than the t-critical value, the null hypothesis was accepted. There is no significant difference between the mean ratings of farmers and extension agents on the mechanisms for enhancing farmers' use of climate smart agricultural practices for improving arable crop production. The null hypothesis is therefore accepted.

IV. DISCUSSION OF RESULTS

The discussion of findings was done based on the results of the data analysed to answer the research questions.

The findings from the study revealed that the climate smart agricultural practices used by farmers for improving arable crop production include: adoption of integrated soil fertility management, crop rotation practice, planting of improved seed, seed treatment, use of pre-emergence herbicide, avoidance of deforestation, use of pesticide and application of organic and inorganic fertilizer. However, the result of the corresponding hypothesis tested indicated that there is no significant difference between the mean ratings of farmers and extension agents on climate smart agricultural practices used by farmers for improving arable crop production. The finding is relate with the study of Adewumi, Tanko, Ibrahim and Yisa (2019) that revealed the climate smart agricultural practices used by farmers include: crop rotation practice, planting of improved seed, use of pre-emergence herbicide, and seed treatment.

The findings revealed that the challenges of farmers' adoption of climate smart agricultural practices for improving arable crop production include: limited access to farmland in terms of crop rotation, inadequate access to agricultural input, financial constraints, lack of access to up to-date information, inadequate government support to farmers, inadequate knowledge of farmers on climate smart practices and high cost of agricultural inputs. Thus, there corresponding hypothesis tested revealed that there is no significant difference between the mean ratings of farmers and extension agents on the challenges of farmers' adoption of climate smart agricultural practices for improving arable crop production. This finding is in harmony with the study of Igberi, et al., (2022) that the adoption of climate smart agricultural practices by farmers are limited by different factors such adequate knowledge of the farmers climate smart agricultural practices and lack of extension information among others.

The findings from the study revealed that the mechanisms for enhancing farmers' use of climate smart agricultural practices for improving arable crop production include: timely supply of agricultural input, Adequate farmers and extension linkage, provision of credit facilities to farmers, provision of adequate information to farmers by extension agents, provision of adequate information to farmers by extension agents, inadequate government support to farmers, farmers education on climate smart practices and provision of subsidy to farmers on agricultural inputs. The corresponding hypothesis three tested indicated that there is no significant difference between the mean ratings of farmers and extension agents on the mechanisms for enhancing farmers' use of climate smart agricultural practices for improving arable crop production. This finding is in agreement with the study of Igberi, Osuji, Odo, Ibekwe, Onyemauwa, Obi, Obike, Obasi, Ifejimalu, Ebe, Ibeagwa, Chinaka, Emeka, Orji, Ibrahim-Olesin, (2022) that the climate smart agricultural practices for improving arable crop production are supply of agricultural input, farmers and extension linkage and provision of adequate information to the farmers.

V. CONCLUSION

It was concluded that the climate smart agricultural practices will help to increase arable crop production. This will help to increases food production for the teaming population and prevent hunger or food insecurity in the research area.

VI. RECOMMENDATIONS

Based on the result of this study, it was recommended that:

- ✓ Extension agents in Ebonyi State should be continuously trained and educated on current information about climate change and climate smart agricultural practices and sent out to enlighten the farmers. This will enable them to update and synchronize ideas with the farmers to enhance crop production to bridge the food security gap in order to eradicated hunger.
- ✓ Farmers should be trained also by the Government of Ebonyi State and well-meaning local and international agricultural organizations on climate smart agricultural practices suitable in this era of climate change.
- ✓ Farmers should be encouraged by providing incentives and subsidizing inputs through provision of drought and disease resistant varieties among others to farmers at an affordable rate which will go a long way in boosting crop production.

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