JOURNAL OF AGRICULTURAL ECONOMICS, EXTENSION & SCIENCE ISSN (Print) 2545-5179, ISSN (Online) 2714-5018
Official Journal of the College of Agricultural Economics, Extension & Science JAEES Vol. 6 No. 3 2020, Pages 40 - 49
www.jaees.org

FARMERS' PERCEPTION OF CLIMATE SMART TECHNOLOGIES IN MITIGATING THE EFFECTS OF CLIMATE CHANGE ON COCOYAM PRODUCTION IN IHI-ALA LGA OF IN ANAMBRA STATE, NIGERIA

[1]Ekweanya, N.M,[2]Onwusika, A.I and Ndukwe, H.C.

CorrespondingAuthors:amakahyginus7@gmail.com,dobis907@gmail.com
Phone no:08069603859;08037837418
Department of Extension and Rural Development, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria
Department of Agricultural Technology, Federal Polytechnic Oko, Anambra State, Nigeria.

Abstract

The study investigated Cocoyam farmers' Perception of agricultural climate Smart Technologies in Mitigating the effects of climate change on cocoyam production in Ihi-Ala Local Government area of Anambra State, Nigeria. Multistage sampling procedure was used to select 80 cocoyam farmers. Data were collected through a well-structured questionnaire and analyzed with descriptive and inferential statistics such as regression analysis. The result showed that weather smart technology (81.3%), water smart technology (62.5%), carbon smart technology (37.8) and nitrogen smart technology (18.8%) were the various levels of awareness on climate smart technology. The study showed that agronomic practices (x=3.40), water management (x=2.90) and tillage and residue management (x=2.85) were the perception farmers had on climate smart technology. The study further showed increase production output (x=2.8), reduced pest infestation (x=2.78), controlled disease (x=2.98) and increase adaptation/resilience (x=2.5) as the various perceived benefits farmers had on climate smart agriculture. The OLS regression showed $R^2$of 0.667 and F-value of 19.792 which was significant at 1% and the coefficient of income (0.450) was positive significant at 1% level. It concluded that climate smart technologies mitigated effect of climate change on cocoyam production. The study recommend that more efforts must be taken to develop policies on awareness creation, intensify the dissemination process on climate smart technologies in the study area.

Keywords: Climate Change, Climate Smart, Women Farmers, Cocoyam Production

Introduction

Climate Smart Agricultural (CSA) practices has been identified as a key element in the successful response to the threats of climate change to sustainable agricultural

production and food security in Nigeria (FAO,2018).Climate change is becoming a threat to sustainable agricultural production and food security in Nigeria. Farmers need to be more resilient to climate change and produce more food through adoption of Climate Smart Agricultural Practices (Saliu, Uduma, Timothy , Rahman, Sanusi, Enitan and Adebayo ,2017).Climate change and agriculture are interrelated, both of which take place on a global scale (Climate Education Modules (CEM), 2010). Global warming is projected to have significant impact on conditions affecting agriculture, including temperature, carbon dioxide, glacial run-off, precipitation and the interaction of these elements.There are innumerable potential effects climate change could have on agriculture. It could affect crop growth, quality, pest control farming practices and the varieties of crops that could be grown in particular climatic areas. These could in turn, affect the availability and price of agriculture products as well as the costs of farming.Climate-Smart Agriculture (CSA) is an approach to help the people who manage agricultural systems respond effectively to climate changeFAO(2010,2013). The CSA approach pursues the triple objectives of sustainably increasing productivity and incomes, adapting to climate change and reducing greenhouse gas emissions where possible.

Cocoyam production is commonly described as the women crop in some states in southeast of Nigeria. Chukwu *et al.*(2014) revealed that cocoyam is a generic name for *Colocasia esculenta* (Tara) and *Xanthosomamafafa* (Tennia) which is cultivated for its corms and cormels which are used as edible aroids.Cocoyam has more food value than yam and cassava in terms of percentage crude protein and essential minerals. Cocoyam corms and cormelsare recommended as edible starch for diabetic patients due to its high glycemic property. Cocoyam as food can be eaten for control, prevention and reduction of some incidence and prevalence of health risks associated with high blood pressure, cardiac problems, prostrate and breast cancers (Chukwu *et al,* 2014).

Women farmers are the principal labour force on small holder farms and perform the largest labour in land preparation, weeding, transporting, processing and marketing of agricultural products (Ugboaja, 2013; Odebode, 2012). This is found to be true in the case of cocoyam where women play an active role in cocoyam production, processing and marketing (Onyenobi et al., 2010).

Climate-smart agricultural (CSA) approach was developed to provide this

assistance. Ogbonna and Orji (2013) pointed out that cocoyam production has suffered serious neglect due to low yield per hectare and low economic return. Among the reasons given for the decline in cocoyam production as the inability of cocoyam industry to increase output include generally climate variabilities which escalate insect vectors causing diseases and pests. Draught associated with climate change causes poor growth and cocoyam development, increase seedling mortality and affect the root size. All these deteriorate quality of produce, reduce quantity produced per year. Inability to combat these anomalies may be due to poor technological approach against climate change variables on cocoyam production in Anambra State. Climate-smart agriculture involves farming practices that improve farm productivity and profitability, help farmers adapt to the negative effects of climate change and mitigate climate change effects, e.g. by soil carbon sequestration or reductions in greenhouse gas emissions (FAO,2013). Climate-smart practices such as the locally practised conservation agriculture, aim at conserving soil moisture, retaining crop residues for soil fertility, disturbing the soil as minimally as possible and diversifying through rotation or intercropping (IPCC, 2014;Saliu , Uduma , Jude And Musediku , 2018). As Nigeria population continues to grow and is expected to double by 2050 (reaching the 1 billion mark),the continent will be challenged to meet the food security and nutritional requirements of its people, while also ensuring continued economic growth and sustainable livelihoods on a continent where agriculture is the backbone of many African countries' economies (Clare,2019).

Several views have been given about the impacts of irregularity of climate on crop production; some assert that rural and poor farmers are more affected(*Ekweanya, Iyang and Okiringbo 2017)*. For these reasons, the study seeks to investigate farmers' perception of climate-smart technologies impacts in offsetting these negative effects on cocoyam production in the study area.

The specific objectives were to;

i. ascertain the level of farmers' awareness of climate smart technology
ii. ascertain the perception of the farmers on climate smart technologies
iii. ascertain the perceived effect of climate change on cocoyam production
iv. determine factors influencing the adoption of climate smart technologies in the study area

Methodology

The study was conducted in Ihiala, a city in Nigeria, located in the southern part of

Anambra State, and has long served as the local administrative capital of the Local Government Area in which its located. The Local Government Area has a population of about 87,796 persons with a Coordinates: 5°51′14″N6°51′36″E. Ihiala Local Government Area consists of several town, such as Amorka, Azia, Lilu, Okija, Mbosi, Iseke, Orsumoghu, Ubuluisuzor and Uli. It lies in the Agricultural belt of Anambra State, which is located in the south-east geopolitical zone of Nigeria.

Multi-stage sampling technique was used in the selection of the sample from the population. The first stage involved the purposive selection of four (4) communities out of the total communities in the selected Local Government Area. This was because; cocoyam production is the major agricultural activity in the communities since most of them use the product to prepare soup for traditional marriages and burial ceremony. The second stage involved simple random selection of one (1) village from the number of villages that make up each of the four communities because; most household farmers that produce cocoyam generate income from it. That is they produce not only for household consumption. Lastly, twenty (20) farmers were randomly selected from each of the villages making the sample size a total of eighty (80). Data for the study were collected through the use of a questionnaire. Data were analyzed using mean score and multiple regression analysis.

Decision rule: A 4-point rating scale of of 4+3+2+1=10/4=2.5

Model specifications

$$Y = \alpha_o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + U$$

Where:

Y = Level of adoption of climate-smart technologies (4= high adoption, 3= moderate adoption, 2= low adoption, 1= no adoption)

X_1 = Age (years)

X_2 = Household size (number of people)

X_3 = Level of education (years)

X_4 = Farming experience (years)

X_5 = Extension visits (number of times)

X_6 = Farm size (hectares)

U = Error term

α_o = Constant term

β_1-β_6 = Regression coefficients.

Results and Discussion

The level of farmers' awareness of climate smart technology

Table 1 revealed that majority the farmers (81.3% and 62.5%) were aware of weather and water smart technology respectively while 93.8% and 81.3% claimed no awareness of carbon and nitrogen smart technology respectively in the study. The result shows progressive awareness of some of the climate smart technologies in the study area.

Hassan and Nhemachena (2008) asserted that awareness is an important determinant of adaptation to climate change effects. Similarly, Maddison (2006) argued that farmers' awareness of climate smart agriculture is important to adaptation decision making. This was further confirmed by Araya and Adjaye (2001) which reported that farmers' awareness and perceptions of climate smart agriculture as a result of changes in climate showed posi

tive effect on crop production.

Table 1: Distribution of respondents according to their level of awareness of climate smart technology in the study area (n = 80)

Climate Smart Technology	Aware (%)	Not Aware (%)
Weather Smart Technology	65 (81.3)	15 (18.8)
Water Smart Technology	50 (62.5)	30 (37.5)
Carbon Smart Technology	5 (37.5)	75 (93.8)
Nitrogen Smart Technology	15 (18.8)	65 (81.3)

Source: Field Survey Data, 2019.

* Multiple respondents were recorded

The perception of the farmers on climate smart technologies

The result in Table 2 showsthe perception of farmers on climate smart technology. The result showed that agronomic practices ranked 1st with a mean of 3.41 on a four point rating scale, integrated soil fertility management with a mean of 2.90 and tillage and residue management with a mean of 2.85 ranked 2ndand 3rd respectively. This implies that farmers had strong perception on climate smart technology because the means responses were

greater than the bench mark of 2.5. Still, the reason for high perception of improved seed varieties could be the favourable policy environment for development and distribution of improved seed varieties to farmers. There is a specialized body- National Seed Certification Council of Nigeria - which was established specifically to administer seed release and production in the country. Research and extension activities were also widely focused on breeding of improved varieties which had led to the release of some rice varieties to farmers (NCRI, 2014).

Table 2: Distribution of respondents according to perception of climate smart technologies (n = 80)

Variables	Agreed (4)	Disagreed (3)	Strongly Agreed (2)	Strongly Disagreed (1)	Mean score	Rank *
Agronomic practices (Improved seed varieties, crop rotation, intercropping, cover crop)	51(63.8)	15(18.8)	10(12.5)	4(5.0)	3.41	1st
Water Management (Irrigation, bunds, terracing, Contouring, water harvesting);	21(26.3)	42(52.5)	9(11.3)	8(10.0)	2.95	2nd
Integrated Soil Fertility Management (Organic fertilizer, efficient use of inorganic fertilizer)	15(18.8)	47(58.8)	13 (16.3)	5(6.3)	2.90	3rd
Integrated Pest Management (blend of cultural, biological and chemical control)	10(12.5)	14(17.5)	18(22.5)	38(47.5)	1.95	5th
Tillage and residue Management (Conservation tillage, incorporation of crop residues)	19(23.8)	42(52.5)	7(8.8)	12(15.0)	2.85	4th

Source: Field Survey, 2019
Decision Rule 2.0 and above = Perceived
Decision Rule <2.0 = Not Perceived
Values in Parenthesis ( ) are Percentages

The perceived effect of climate smart technologies on cocoyam production

Table 3 shows the result of perceived effects of climate smart technology on cocoyam production. The result showed that controlled disease was ranked 1st with a mean of 2.98, increased production output ranked 2nd with a mean of 2.85, reduced pest infestation

ranked 3rd with a mean 2.78 and increased livelihood ranked 4th with a mean of 2.73 respectively. This result implies that Climate-smart agriculture (CSA) is increasingly gaining ground as a valuable tool in tempering the negative effects of weather-based changes on agricultural output.

Vernooy *et al*. (2018) revealed that through the practice of smart technologies, farmers had good bio-fertilizer for their crops and vegetables. The result also confirmed decrease soil erosion, increase soil fertility, increased productivity, less soil erosionas the effects of practicing climate smart technologies in 2015 by household farmers. These results were observed and/or measured through visual observations mostly.

Table 3: Distribution of respondents according to perceived effects of climate smart technology on cocoyam production (N = 80)

Perceived Effects	HI	MI	I			Mean	Rank *
Increased production output	30	20	18	12	228	2.85	2nd
Reduced pest infestation	28	16	26	10	222	2.78	3rd
Early maturity	42	18	12	8	146	1.83	6th
Controlled Disease	30	28	12	10	238	2.98	1st
Increased livelihood	16	24	6	34	218	2.73	4th
Increased adaptation/resilience	36	9	22	13	228	2.85	2nd
Increased soil fertility	26	16	12	26	202	2.53	5th

***Source: Field Survey**, 2019.* HI = highly intense; MI = moderately intense; I = intense; NI = not intense
Decision Rule: 2.0 and above = Perceived
Decision Rule:<2.0 = Not Perceived

Factors influencing level of adoption of climate smart technologies

Table 4 shows that the coefficient of multiple determinations was 0.667 implying that 66.7% of the variations in cocoa production level or output were accounted for by the variables included in the model. The F- ratio was significant at 1% indicating the goodness of fit of the model. Specifically, only the coefficient of income (0.450) was positive and statistically significant at 1%/.This implies that income was positively related to the level of adopting the various options of adaptation to climate smart technology.Increase in farmers' income enables farmers to adopt recommended adaptative strategies to adjust to challenges of climate change; this is because farmers with high income will be able to produce more cocoyam than the farmers with low income.

This result corroborates with the findings of Saliu*et al.* (2017)who had noted in their respective studies, that there was a positive relationship between the selected socio-

Table4: Regression estimation of factors influencing level of adoption of climate smart technologies

Variables	Coefficient	T-value	Significance
Constant	-3.027	-0.475	NS
Age(X_2)	- 0.050	-1.287	NS
Household size(X_4)	2.904	0.055	NS
Education (X_5)	0.311	1.436	NS
Extension visit (X_7)	0.250	1.486	NS
Farm Income (X_8)	0.450	3.956***	S
Farming Experience (X_9)	0.466	0.369	NS
R^2	0.667		
Adj.R^2	0.633		
F. value	19.792***		

Source:Field Survey, 2019 *** = Significant at 1%

Conclusion and Recommendations

The study concluded that the cocoyam farmers were aware of some climate smart technologies and that climate smart technologies were able to mitigate effect of climate change on cocoyam production the following recommendations were made:

i. To ensure successful adaptation to climate change, concerted efforts are needed to design and promote planned adaptation measures that fit into the local context and also educate farmers on climate changes and climate smart technologies which can reduce vulnerability and escalate cocoyam production level per annum.

ii. More efforts must be taking to develop policies on awareness creation; intensify the dissemination process on climate smart technologies.

iii. Policy formulation that will enhance socio-economic conditions of the farmers should be uphold to enable them adopt climate smart technologies and consequently, adapt to the adverse effects of climate change in various agricultural activities.

References

Araya, B. and J.A. Adjaye.(2001). Adoption for farm level soil conservation practices in
--- Eritrea. *Indian Journal of Agricultural Economics,* 56:239-252.

Chukwu, G, Okoye, B. C., Onwubiko, O., Okonkwo, E. I. &Amadi, C. O. (2014).Gocken Technology:

Ehancing Health of HaplicAcrisols and Multiplication of Taro in Nigeria. Asian Journal of Science and Technology.

Chukwu, G. O. and Eteng, (2014). Enhancing Soil Health and Control of Cocoyam Root Through Integrated plant Nutrition, Basic Reasearch Journal of Soil and Environmental Science. *Basic research journals 6(4): 40 – 45*

Clare, P. (2019). **Catalysing actionable knowledge to implement climate-smart solutions for next-generation ACP agriculture.** Capitalisation workshop organised by CTA held in Wageningen, The Netherlands from January 22-25.

Climate Education Modules (CEM) (2010). Effects of climate change on agriculture. http://www.nc-climate.ncsu.edu/edu/K12/climatechange.As

Ekweanya, N.M, Iyang,N.U and Okringbo,J.I (2017) Factors Affecting Farmer's Adoption of Coping Strategies of Climate Change in AnambraState,Nigeria. Journal of Community and Communication Research 2 (2):212-217

FAO(2013), Climate-Smart Agriculture Sourcebook. Food and Agriculture Organization of the United Nations, Rome.http://www.fao.org/docrep/018/i3325e/i3325e04.pdf 22/12/16

FAO,(2014), Adoption of Climate-Smart Agricultural Practices: Barriers, Incentives, Benefits and Lessons Learnt from the MICCA Pilot Site in Kenya. Final Report prepared by Morgan C. Mutoko for MICCA Programme in December, 2014

FAO.(2018). Climate-Smart Agriculture Case Studies 2018. Successful approaches from different regions. Rome. 44 pp. Licence: CC BY-NC-SA 3.0 IGO

FAO.(2010). "Climate-Smart" Agriculture Policies, Practices and Financing for Food Security, Adaptation and Mitigation. Available at:

Hassan, R and Nhemachena, C. (2008). Determinants of African farmers' strategies for adapting to climate change: Multinomial choice analysis. *AfJARE*Vol 2(1):83-104.

Heijnan, J. and Kates, R. (1974). Northeast Tanzania: *Corporative Observations Along a Moisture Gradient in GF White (ed)*. Natural Hazards: Local, National and Global.

Oxford University Pres

Inter governmental Panel on Climate Change (IPCC) (2007). Agriculture and food supply, climate change health and environmental effects. www.cpa.gov/agriculture.html retrieved 2nd February 2012

Maddison, D. (2006). The perception of andadaptation to climate change in Africa. CEEPA.Discussion Paper No. 10. Centre for Environmental Economics and Policy in Africa.Pretoria, South Africa: University of Pretoria.

Mohammed N .U (2014).Factors affecting farmers' adaptation strategies to environmental degradation and climate change effects: A Farm Level Study in Bangladesh. Climate. 2, 223-241

NCRI,(2014), Best practices and Natural Resources Management for rice production in Nigeria, National Cereals Research Institute, pp54

Onyenobi, V.O., Chukwu, G.O., Asumugha, G.N., Okoye, B.C., Ewuziem, J.E., Ogbonna, M.C. and Akinkpelu, A.O. (2010).Marking of edible cocoyam, xanthosoma species (tannia) in Abia State Nigeria. National root crops research institute Umudike, Abia State annual report no. 10 vol. 15

Saliu A. T., Uduma B. U.,Jude N. E. and Musediku A. S. (2018). Adoption of climate smart agricultural practices and farmers' willingness to accept incentives in nigeria. Scientific Research Council.International Journal of Agricultural and Environmental Research. 4(4):198-205

Saliu A.T., Uduma B.U., Timothy F., Rahman O. S., Enitan O.F. and Adebayo M.S. (2017). Analysis of farmers‟ adoption of climate smart agricultural practices in Northern Nigeria. Proceedings of the 4th International Conference on Agriculture and Forestry, Vol. 3, 2017, pp. 19-26

Vernooy, R., Le Kai Hoan, Nguyen Tuan Cuong, Bui Le Vinh. (2018). Farmers' own assessment of climate smart agriculture: Insights from Ma village in Vietnam. CCAFS Working Paper no. 222. Wageningen, the Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Available online at: www.ccafs.cgiar.org