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Climate Change: Effects and Adaptation Strategies Among Orange Fleshed Sweet potato (ofsp) Farmers in Anambra East and West Local Government in Anambra State, Nigeria

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Abstract

The study investigated the effects of climate change and adaptation strategies among Orange Fleshed Sweet potato (OFSP) farmers in Anambra East and West local government in Anambra State, Nigeria**.** The specific objectives of the study were to assess the sources of information on climate change by the farmers, determine the causes of climate change in the study area, ascertain the perceived effects of climate change on OFSP farmers, assess the adaptation strategies used by the farmers and identify constraints to climate change adaptation strategies. Multistage sampling techniques were used for the study. Two local governments out of the 21 local governments in the states were purposively selected because of their yearly effects on climate change 12 OFSP farmers were randomly selected from each community and this gave a total of 120 farmers used for the research. Data collected were analysed using frequency, percentage and mean scores. Findings indicated that majority (66.7%) of the farmers were females while 33.3% of the rest were males. The mean age, years of farming experience, household size and farm size of the farmers were 32years, 20years, 8 persons and 2.1 hectares respectively. However, 37.5% of the farmers were married, 20.8% were singles while 16.7% were widowed. The findings also revealed that the farmers used personal experience (70.8%), fellow farmers (66.7%), radio (62.5%), friend/neighbours (58.3%), facebook (54.2%), extension agents (45.8%), Anambra State Agricultural Development Programme (41.7%) and television (33.3%) as their major sources of information on climate change. However, flooding (3.31), drought (3.30), excessive rainfall (3.22) and deforestation (2.20) were identified as the major causes of climate change in the study area. Farmers saw the perceived effects of climate change on OFSP as rotten of OFSO roots (3.45), declined in crop yield (3.20), high incidence of pests and diseases (3.11), food insecurity (3.10), loss of lives and properties by the farmers (2.55), reduction of market value of crops (2.40), ill health status of the farmers (2.30), causing damages on roads (2.15), incidence of poverty among farmers (2.14) and displacement of farmers from natural domain (2.12) respectively. The results further revealed that the adaptation strategies used by the farmers were shifting from high flooding areas to the less flooding areas(3.50),planting of disease/pest resistant varieties(3.39),planting on mounds and ridges(3.30),planting drought tolerant crops(3.21) and practice of earlier

cropping method(2.35).Constraints faced by the farmers as regard to climate change strategies were; lack of government interventions(3.35),traditional beliefs(3.20), lack of access to information(3.11),illiterate levels of the farmers(3.10),low knowledge of climate change adaptation(2.56) and lack of knowledge on weather forecast by the farmers(2.35). In conclusion, Climate change is a change in global weather patterns which caused by more extreme weather events like storms, floods, drought, rainfall and temperature . In view of the findings, this paper recommended that organization of capacity building programs relevant to climate change and adaptation strategies among farmers should be encouraged. Extension curriculum should as well be reviewed to accommodate the training of extension personnel on climate change and adaptation strategies

Keywords: adaptation strategies; climate change; effects; mitigations; OFSP farmer

Introduction

Sweet potato (Ipomoea batatas L.) is a dicotyledonous plant from the morning glory family (Convovulaceae), which produce roots that are edible [15]. Nigeria is the second largest producer of sweet potato in the world after China with an annual output of 3.46 million metric tons per year [13]. The crop has the ability to thrive in less fertile soils, but beyond this, the wide agro-ecological adaptability of the crop makes it a food security and staple crop as it can be grown in all 36 States of Nigeria [2, 6, 11]. As a staple crop, it has been fortified in key vitamins, especially vitamin A and minerals whose deficiency in most rural diets continue to pose a very serious constraint to human health and economic development [4].

Vitamin A deficiency is a major risk factor for pregnant and lactating women and also a leading cause of visual impairments such as xerophthalmia, corneal scars and corneal xerosis [12]. In extreme cases, it leads to premature death in children and pregnant women (United State Agency for International Development [USAID], 2016). Globally, about 3 million pre-school children have been reported to present ocular signs of vitamin A deficiency (Mendu Nair and Athe, 2019). In sub-Saharan Africa, it has been estimated that 43 million children under the age of 5 are vitamin A deficient [10]. In Nigeria, the prevalence of vitamin A deficiency (VAD) affects 29.5 % of her population, resulting to the World Health Organization (WHO) listing Nigeria as one of the number one countries [2] with the highest risk of vitamin A deficiency [5].

In rural Nigeria, most households cannot afford food products rich in vitamin A and this gave rise to the introduction of biofortified agricultural produces like orange flesh sweet potato varieties (Babatunde, Adeyemi and Adebanke,2019). Orange-Fleshed Sweet potato (OFSP) is an improved breed of sweet potato (Ipomea batatas [L.] Lam.). It cultivated in tropical and semi-tropical regions of the world for food and source of income especially among the rural dwellers [1] It can be grown in wide range of agro-ecologies and soil types. OFSP is easy to cultivate, it is a crop with immense ability to grow in marginal fields (Afuape, 2014). It can be vegetatively propagated, and has fairly drought resistant ability once established. It has short maturity period compare to other root and tuber crops. These characteristics make OFSP an excellent food security crop in Sub-Saharan Africa (Nyor, Mbanasor, and Nto, 2017).

Agricultural practices in the developing world such as African countries are subject to climate change effects. The drastic changes in weather always have after effects on agricultural activities, particularly in places where agricultural operations are weather dependent, and these effects may be detrimental if not catastrophic in some cases [9,14]. However, as communities try to adjust to the challenges of recent climate events: tornadoes, frequent droughts and floods, as well as forest fires, snows, among others. Though this event may be global, its outcomes may not be easily generalized. However, in some cases there could be spillover effect as observed in recent flooding in Nigeria (Benue, Edo, Kogi, Anambra, Delta, Bayelsa, Taraba and Rivers States) owing to torrential rainfall and the sudden release of water from the dams in Cameroun; compounded by the fact that Nigeria is of higher elevations in the north than in the south [9,8,14]. This makes the country a sloping geomorphic entity with most of her

hydrological resources trickling down towards the south from the north [8]. This orientation should be expected to affect how climate change events impact on the country, particularly heavy rain fall and flooding in the north which may find their ways into the river Niger and Benue, with possible spillover effects on surrounding lands bordering the two rivers. This horror was seen in the 2012 and 2022 flooding of over 19 states in Nigeria, with the destruction of properties and crops, cutting off roads, wiping out farm lands [9].

Climate change is a change in global weather pattern which caused by more extreme weather events like storms, flood, drought, rainfall and temperature. Agriculture which is the pillar for nation building is extremely vulnerable to climate change. Therefore, what affects agriculture indirectly, affects all directly. Climate change has a mixed effect on agriculture with some areas benefiting from moderate temperature increase and others being negatively affected [17]. In the light of this, the paper investigated climate change: effects and adaptation strategies among orange fleshed sweet potato (OFSP) farmers in Anambra East and West local government in Anambra State, Nigeria. The specific objectives were to; assess the sources of information on climate change by the farmers, determine the causes of climate change in the study area, ascertain the perceived effects of climate change on OFSP farmers, assess the adaptation strategies used by the farmers and identify constraints to climate change adaptation strategies.

Methodology

The study area for this research is Anambra East and West. Anambra East and West are local government area in the northwestern part of Anambra state, Nigeria with headquarters at Otuocha Nzam. The communities that make up Anambra West local government are as follows: Mmiata Anam, Umuoba-Abegbu Anam, Umuenwelum Anam, Oroma-Etiti Umueze Anam, Umudora Anam, Umuikwu Anam, Inoma-Akator, nzam, Igbedor and Iyiora Anam while those that make up Anmbra East are; Nsugbe, Igbariam, Nando, Otuocha, Anam, Aguleri Out and Umueri. Farming and fishery are the major occupation of the people in the area. Anambra East and West are also rich in crude oil and natural gas. Types of crops grown are yam, cassava, maize, potato, okro, rice among others.

Multistage sampling techniques were used for the study. Two local governments out of the 21 local governments in the states were purposively selected because of their yearly effects on climate change. More so, five (5) communities were selected from each local government, this gave a total of ten (10) communities used for the study. However,12 OFSP farmers were randomly selected from each community and this gave a total of 120 farmers used for the research. Data collected were analyzed using frequency, percentage and mean scores.

Results and Discussions

Socio-economic characteristics of orange fleshed sweet potato farmers

Table1 show that 66.7% of the farmers were male while 33.3% of them were female. This implies that male dominated farming activities in the study area. Majorities (37.5%) of the farmers were married while 20.8% of the farmers were single. This implies that the farmers are more likely to have children that might have been affected by climate effect or more people that can help to secure their properties against climate change. This result is in consonance with the finding of Falola and Achem which found in their study that the majority (77.1%) of the respondents were married. The average mean age was 36 years. The indication is that farmers were predominantly in their active productive age and this could increase their stamina for production. Majority (41.7%) of the farmers had formal education while 21.6% of them completed secondary education. High levels of illiteracy among farmers could deprive them chance to adopt the recommended strategies for climate change. The finding contradicted that of [3] that rural farmers were characterized with low level of literacy. However, 48.3% of the farmers cultivated less than 1 hactre while 30.8% of others cultivated 2-3 hactare. The average farm size of the farmers was 2.1 hactre. This implies that farmers were still under small scale farming. This finding is in line with the findings of Chinaka and Udemezue (2015) which said in their study that farmers in

Anambra state were small scale farmers. The mean year of farming experience was 20 years. This implies that the farmers had long period of farming experience and this could enhance their knowledge on farming activities. Greater proportion (37.5%) of the farmers sourced agro-inputs from fellow farmers while 31.7% of others sourced agro-inputs from Anmbra State Agricultural Development Programme (AADP). Similarly 50% of the farmers made use of family labour in their farm while 33.3% of them used hired labour. Majority (58.3%) of the OFSP farmers inherited land from their parents. More so the average household size of the farmers was 8 persons. This likely indicates that OFSP production is a means of catering for the family in the study area. Majority (75%) of the farmers did not have access to extension services while 25% had access to extension services. Those of the farmers who did not have access could be as a result of the inability of extension workers to discharge their official duty diligently or it could be due to inadequate extension workers to cover a wide range of farmers within a stipulated time. On the other hand, 66.7% of the farmers did not have access to credit loan while 58.3% of them belonged to social organization.

Table 1: Socio-economic characteristics of OFSP farmers

Variables	Frequency	Percentage	Mean
Sex			
Male	40	33.3	
Female	80	66.7	
Age			
18-25	20	16.7	32 years
26-35	50	41.7	
36-45	30	25	
46 and above	20	16.7	
Marital status			
Married	45	37.5	
Single	25	20.8	
Divorced	15	12.5	
Separated	15	12.5	
Widowed	20	16.7	
Educational level			
Non formal education	20	16.7	Primary school
Primary school	50	41.7	
Secondary school	26	21.6	
OND/HND	10	8.3	
First degree and above	14	11.6	
Farming experience			
1-10 yrs	38	31.7	
11-20 yrs	40	33.3	
21-30 yrs	10	8.3	20 years
31-40 yrs	16	13,3	
41 and above	16	13.3	

Farm size hectare			
0.5-1 ha	58	48.3	2.1hectare
2-3 ha	37	30.8	
4-5 ha	25	20.8	
Source of agro inputs			
Friends/neighbor	10	8.3	
Extension agent	10	8.3	
Research institute	15	12.5	
Input dealers	2	1.7	
AADP	38	31.7	
Fellow farmers	45	37.5	
Source of labour			
Family	60	50	
Hired	40	33.3	
Exchange	20	16.7	
Source of farm land			
Inherited	70	58.3	
Rented	20	16.7	
Purchased	30	25.0	
Household size			
1-2	40	33.3	
3-4	50	41.7	8 persons
5-6	10	8.3	
7-8	15	12.5	
9 and above	5	4.2	
Access to credit loan			
Yes	40	33.3	
No	80	66.7	
Access to extension service			
Yes	30	25.0	
No	90	75.0	
Membership of social organization			
Yes	70	58.3	
No	50	41.7	

Source: field survey,2020

Sources of Information on climate change

Table 2: shows that the majority (70.8%) of the orange fleshed sweet potato farmers sourced information on climate change from personal experience, while 66.7% of them also sourced information on climate change from fellow farmers. Similarly, 62.5% and 58.3% of OFSP farmers sourced information on climate change from radio and cooperative, while 54.2% and 45.8% of the OFSP farmers sourced information on climate change from face book and extension agent. However, 41.7% and 33.3% of the OFSP farmers sourced information on climate change from AADP and television. On the other hand, 29.2% of the OFSP farmers sourced information on climate change from cooperative while the remaining OFSP farmers sourced information on climate change from WhatsApp (20.8%), research institute (16.7%), newspaper (15%) and university (8.3%) respectively. WhatsApp, research institute, newspaper and University lecturers were the least source of information. This could be attributed to the fact that most of the OFSP farmers do not have easy access to WhatsApp, research institute, newspaper and University. The farmers used personal experience, fellow farmers, radio and cooperative more than other information sources. However, long time of farming experience and frequent access to fellow farmers, radio and cooperative could also facilitate the adoption of the adaptation strategies recommended for climate change. Since personal experience, fellow farmers, radio and cooperative dominated the information sources used by the OFSP farmers in the region on climate change, it therefore would be appropriate to deliver information on climate change to farmers through fellow farmers, fellow farmers and cooperative respectively. In the light of these, the finding contradicted the research conducted by [16] in Pakistan, which affirmed that a greater proportion of farmers ranked neighbor-friends-relatives as first source of information. Therefore, farmers' preference for any information source could be a stepping stone for agricultural production in a developing country like Nigeria and it could be also significantly influence adoption of improved technologies in a social system provided that the social norms are not tampered with.

Table 2: Source of information on climate change

Information sourced	Frequency	Percentage
University	10	8.3
Research institute	20	16.7
AADP	50	41.7
Fellow farmers	80	66.7
Radio	75	62.5
Television	40	33.3
Personal experience	85	70.8
News paper	18	15.0
Cooperatives	35	29.2
Friends/neighbours	70	58.3
Extension agents	55	45.8
Face book	65	54.2
WhatsApp	25	20.8

Source: field survey,2020

Causes of Climate Change

Table 2 shows that the respondents perceived flooding (M=3.31), drought (M=3.30), excessive rain fall (M=3.22), deforestation (M=2.20), application of excess nitrogenous fertilizers (M=3.50), bush burning (M=2.23) and use of excessive agro-chemical

(M=2.34) the adverse cause of climate change to great extent. Other causes of climate change such as overgrazing, depletion of ozone layer, crude oil spillage, changes in land use and CO2 emissions from transportation, with low mean (M) scores of 1.4,1,3,1.33,1.22,1.11, and 1.10, did not cause climate change (perceived as to no extent).

Table 3: Causes of climate change

Variables	Mean
Flooding	3.31
Deforestation	2.20
Bush burning	2.23
Excessive rainfall	3.22
Drought	3.30
Overgrazing	1.40
Depletion of ozone layer	1.30
Over application of nitrogen fertilizers	3.50
Use of excessive agro-chemical	2.34
Crude oil spillage	1.33
Change in land use	1.11
Co2 emission from engine	1.10

Source: field survey,2020

Perceived effects of climate change on orange fleshed sweet potato

Figures in table4 indicate the various perceived effect of climate change (flood) by the farmers in the study area. The effects were categorized as very serious = 3, serious = 2 and not serious = 1. The effects were later ranked in the descending order of their sequence. Rotten of OFSP roots with a weighted mean score 3.45 was ranked first, declined in crop production with a weighted mean score 3.20, incidence of poverty among farmers(3.12), high incidence of pest/diseases with a weighted mean score 3,11, food insecurity (3.10) , high incidence of poverty (2.53).Change in weather which brought about malaria disease (2.35), loss of properties (2.55),reducing market values of crops(2.40) and causing damages on road with a weighted mean score 2.30 were perceived as serious effect of climate change to farmers in the study area. This finding is in line with that of Udemezue (2017) that loss of property, reduction in market value, high incidence of poverty and damages on the roads as the perceived effect of climate change in the study area. However, the finding is also in line with Falola and Achem (2017) who saw increased pest and disease attacks, reduceduction in output, crop losses, increased cost of production and reduced farm income as some of the negative impacts of climate change on small scale orange fleshed sweet potato farmers in Kwara State, Nigeria.

Table 4: Perceived effects of climate change on OFSP farmers

Variables	Mean
Declined in crop yield	3.20
Rotten of OFSP roots	3.45
Causing cholera and meningitis	2.30
Loss of lives and properties	2.55
Brought about food insecurity	3.10

Causing too much manure to soil	1.30
Reducing market value of crops	2.40
Displacement from natural domain	2.12
High incidence of poverty among farmers	2.14
Causing damages on road	2.6
High incidence of pests and diseases	3.11

Source: field survey,2020.

Adaptation strategies to climate change

Figures in Table 5 indicate the coping strategies used by farmers as regards to climate change. The coping strategies were grouped into always, sometime, and not at all, respectively. Shifting from high flooding areas to the less one with a weighted mean score 3.50, planting of disease/pest resistant varieties with a weighted mean score 2.39, planting on mounds and ridges with a weighted mean score 3.30, planting drought tolerant crops with a weighted mean score 3.21 and practicing of planting early maturity crops with a weighted mean score 2.35 respectively were adopted by the farmers as the best option for managing the climate change in the study area. In the light of the above, this finding, therefore, disagreed with [3] who said that the most commonly used coping strategies by farmers in Kwara state were changing planting and harvesting dates, alteration of the time of ploughing, the use of varieties tolerant to climate stress, spraying, crop diversification and switching to other sources of income.

Table 5: Adaptation strategies used by the farmers

Variables	Mean
Planting of disease/pest resistance variety	3.39
Planting on mounds and ridges	3.30
Creation of dams	1.30
Shifting from high flooding area to less ones	3.50
Use of multiple cropping	1.25
Moderate use of agro-chemicals	1.31
Practice of early cropping method	2.35
Diversification in crop production	1.40
Planting drought tolerant crops	3.21
Use of excessive agro-chemicals	1.11
Planting of trees	1.32

Source: field survey,2020.

Constraints to climate change adaptation

The constraints faced by farmers in OFSP production practices are presented in Table 6 below. Those constraints are inadequate government interventions(M=3.35), traditional beliefs(M=3.20), lack of access to information(M=3.11), high illiterate levels among farmers(M=3.10), low knowledge on climate change adaptation(M=2.56) and no knowledge of weather forecast (M=2.35) respectively. Other constraints that are not so much effective are; lack of credit facilities, inadequate canoe for transportation, communal way of land ownership, inadequate extension knowledge by the farmers and high cost of speed boat.

Table 6: Constraints to climate change adaptation

Variables	Mean
Inadequate government interventions on climate change	3.35
Traditional belief	3.20
Lack of access to information on climate change	3.11
High illiterate level among farmers	3.10
Low knowledge on climate change adaptation	2.56
No knowledge of weather forecast by the farmers	2.35
Lack of credit facilities	1.25
Inadequate canoe for transportation	1.19
Communal way of land ownership	1.17
Inadequate extension knowledge by the farmers	1.15
High cost of speed boat	1.13

Source: field survey, 2020.

Conclusion and recommendations

Agricultural practices in the developing world such as African countries are subject to climate change effects and the drastic changes in weather always have negative effects on agricultural activities, particularly in places where agricultural operations are weather dependent, and these effects may be detrimental if not catastrophic in some cases. In view of this, Findings of the study indicated that majority (66.7%) of the OFSP farmers were females while 33.3% of the rest were males. The mean age, years of farming experience, household size and farm size of the OFSP farmers were 32years, 20years, 8 persons and 2.1hectares respectively. However, 37.5% of the farmers were married, 20.8% were singles while 16.7% were widowed. The findings also revealed that the farmers used personal experience, fellow farmers, radio, friend/neighbours, facebook, extension agents, Anambra State Agricultural Development Progamme and television as their major sources of information on climate change. However, flooding, drougt, excessive rainfall and deforestation were identified as the major causes of climate change in the study area. The perceived effects of climate on farmers were rotten of OFSP root, declined in crop production, incidence of poverty among farmers, high incidence of pest/diseases, food insecurity, change in weather which brought about malaria, meningities, among other diseases, loss of lives and properties, reducing market values of crops and causing damages on road. Shifting from high flooding areas to the less one, planting of disease/pest resistant varieties, planting on mounds and ridges, planting drought tolerant crops and planting of early maturity crops were adopted by the farmers as the best option for managing the climate change in the study area. Inadequate government interventions on climate change, traditional beliefs, lack of access to information, high illiteracy among farmers, no knowledge of weather forecast and lack of knowledge on climate change were reported as the constraints to adaptative strategies. This paper recommends that stakeholders of weather forecast in collaboration with extension agents should make it known to farmers in order to be abreast with weather condition. Some other coping strategies stated by intergovernmental panel on climate change (IPCC) should be articulated into their beliefs and norms of the farmers in order to have a wider knowledge on climate change and mitigation. Stakeholder and extension agents should organize a workshop on climate change for farmers in the study area to enable them have a proper knowledge on climate change and mitigation. Human activities that cause climate change such as deforestation, burning, and illegal opening of dams, among others should be discouraged. Organization of capacity building programs relevant to climate change and adaptation strategies among farmers should be encouraged. Extension curriculum should as well be reviewed to accommodate the training of extension personnel on climate change and adaptation strategies.

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