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Research Article

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Farmers Perception of Climate Change on Yam Yield in Ehime Mbano Local Government Area, Southeastern Nigeria

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Abstract Climate change is one of the most significant factors influencing agricultural production. The extent to which farmer's perceive the influence of climate change on yam yield (Dioscorea) in tropical environment, Nigeria inclusive has not received the research attention it deserves. Therefore this study examined farmer's perception of climate change on yam yield in Ehime Mbano local government area of Imo state, southern Nigeria. The study employed the use of secondary and primary data. A multistage random sampling technique was used in the selection of yam producing communities. Data was collected with the aid of a structured questionnaire, 102 copies of questionnaire retrieved from farmers were analyzed statistically using Chi-square. Results showed that, farmer's are aware of the influence of climate change on yam yield. Educational level revealed X^2 calculated (37.297) and X^2 critical (5.99) respectively. Implying that educational level influences farmer's perception of climate change on yam yield. Farm size of farmer's revealed X^2 calculated (119.41) and X^2 critical (7.81) with which shows that, farmer's farm size influences their perception on yam yield. Also results indicated that years of farming experience revealed X^2 calculated value of (51.73) and X^2 critical value of (9.49) with the implication that, farmer's years of farming experience influence their perception of Climate change on yam yield. 78.4% of respondent's which is the highest, perceive effects of Climate change as low yield and stunted growth of yam due to excessive rainfall and temperature. In conclusion, farmers are aware of the influence of climate change on yam yield in the study area. It is recommended for farmer's to treat their seedlings before sowing, apply soil amendments and adopt different planting dates to help combat the effects of climate change on yam yield.

Keywords Climate change, farmers, perception, yam yield

Introduction

Weather and climate have always been a key factor in agricultural/crop production. However, variations and changes in climate in recent times have caused drastic changes on agricultural production. Over the past few years, climatic factors have played important role than man-made factors on agricultural problem [1]. Climate change/variability is one of the most significant factors influencing year to year crop production, even in high yield and high technological areas. Crop yield affected by climate change is projected to be different in various areas, in some areas crop yield will increase and for others it will decrease depending on latitude [2]. Farmers' knowledge about climate change is key and largely determines what strategies they adopt in their attempt to reduce adverse effects of climate change [3]. Other studies have gone further and assessed the accuracy of farmers perception to climate change, for instance, Gbetibouo *et al.*, [4] compared farmers perception of long term change in temperature and precipitation with climate trend records at nearby meteorological station and found out that farmers perception were in line with the actual climate data.

Yams (*Dioscorea* species) are annual root tuber-bearing plants with more than 600 species out of which six are socially and economically important in terms of food, cash and medicine [5]. Some of its species are water yam

(*Dioscorea alata)*, white yam (*Dioscorea rotundata*) and yellow yam (*Dioscorea cayanensis)* [6-8]. Yam as a staple food crop is grown in tropical regions [9] and mostly produced in the savannah region of West Africa, where rainfalls are divided into wet and dry seasons [6, 10]. Yams are the fifth most harvested crops in Nigeria, following after cassava, maize, guinea corn, and beans/ cowpeas. More so, after cassava, yams are the most commonly harvested tuber crops in the country. It is the foremost staple food in many parts of Nigeria, especially among Ekiti people who also provide a contact center for its purchase in Nigeria [11]. It is important and also constitutes as a gift for bride price in marriages and a major menu in ceremonial places. There is a decline in yam production in some parts of Nigeria, this decline in average yield per hectare in Nigeria has been a rather drastic dropping from 14.9% in 1986 -1990 to 2.5% in 1999. The two major issues that have recently dominated international development debate are climate change on one hand and survival of agricultural production system on another hand [12]. Perception strongly affects how farmers deal with climate induced risks and opportunities and their behavioral responses to this perception will shape adaptation option, processes involved and adaptation outcome [13]. It has been recognized that people make decisions in their environment not the way the environment is, but the way that perceive it [1].

The way the farmers perceive the changes in climate has the tendency to influence the coping strategies and ultimately determine the extent to which climate change will impact on agricultural production [14]. The 4th IPCC assessment [15] reported that Africa which include Nigeria will be worst hit by the effect of climate change. Deteriorating water resources at farm level as a result of climate change has led to decrease in crop yield in sub- Sahara Africa [3]. Ayanwuji *et al.*, [16] farmers in Oyo state perceive climate change as delayed rainfall, higher temperature, unusual heavy rainfall, undefined season flood, late fruiting of crops, stunted growth and quick spread of pests and diseases. In Ekiti state yam farmers has a high awareness level of climate variation and unfavorable perception about the effect of climate change on yam production. Farmers in Kajola perceive climate change as unpredictable nature of sun intensity, temperature and rainfall. Greater percentage of farmers in the area has a favorable perception of climate change [17]. The 4th IPCC assessment [15] reported that Africa Nigeria inclusive, will be worst hit by the effect of climate change. Deteriorating water resources at farm level as a result of climate change has led to decrease in crop yield in sub- Sahara Africa [3]. Ayanwuji *et al.*, [16] farmers in Oyo state perceive climate change as delayed rainfall, higher temperature, unusual heavy rainfall, undefined season flood, late fruiting of crops, stunted growth and quick spread of pests and diseases. In Ekiti state yam farmers has a high awareness level of climate variation and unfavorable perception about the effect of climate change on yam production. Farmers in Kajola perceive climate change as unpredictable nature of sun intensity, temperature and rainfall. Greater percentage of farmers in the area has a favorable perception of climate change [17]. Tomato farmers perceived decrease in tomato production as an effect of climate change in Nigeria [17].

Agricultural production in Nigeria is largely dependent on climatic forces, rain-fed agriculture still accounts for 95% of the total food production. Hence, Nigeria will be largely threatened by climate change. Understanding farmers' perception of the effect of climate change on crop production is a key information that can transform agricultural production in Nigeria. Therefore this study examined farmer's perception of climate change on yam yield in Ehime Mbano local government southern Nigeria.

2. Materials and Methods

Study Location

Ehime Mbano a local government area in Imo State, Nigeria is located within latitude 5º 66´ ¹ºN and 5º 4´ 90N and longitude 7º 30E and 7º 58´E. It occupies a land mass of about 65 square kilometers and lies within the humid tropical climate with annual rainfall and temperature of over 2000mm and 20℃ respectively [18]. It has common boundary with Mbaise and their major language being Igbo. Farming and trading is their common occupation.

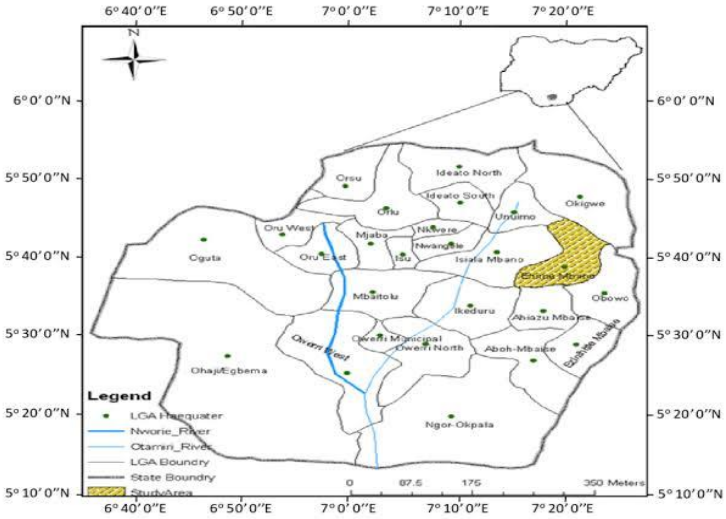

Figure 1: Map of Imo state showing the study area [19]

2.1: Methods of data collection

The study deployed the survey research design. Data for this study were source from both the primary and secondary sources. Multistage random sampling technique was used in the selection of yam producing communities. 120 copies of structured questionnaire were distributed with 30 copies randomly administered in each of the four communities selected based on the communities that produces yam the most. Data was analyzed statistically using chi-square. Descriptive statistics such as tables, frequencies and percentages were used to describe the perception of the respondents.

3. Results and Discussion

The table 3.1 shows computed frequency and percentage of the farmer's socio-economic characteristics, their perception of climate change and its influence on yam yield in the study area. The table 3.1 shows compute data on socio-economic characteristics of farmers.

Table 3.1: Farmers educational qualification and perception of climate change on yam yield

Educational qualification	Observed frequency	Expected frequency	Oi -Ei	$(O-Ei)^2$	$(Oi-Ei)^2/Ei$
None	10	34	-24	576	16.941
Primary /secondary	60	34	26	676	19.882
Tertiary	32	34	-4	16	0.471
Total	102	102			

Source: Authors computation, 2021.

The table of percentile values for the chi-square distribution shows that, the critical value of X^2 at 0.05 (95%) for 2 degree of freedom is 5.99. And since the calculated value of chi-square is 37.294, which is greater than the critical value of 5.99. We conclude therefore that educational qualification of farmer's influences their perception of climate change on yam yield in the study area.

Table 3.2: Farmer's farm size and perception of climate change on yam yield

Farm size	Observed frequency	Expected frequency	Oi -Ei	$(O-Ei)^2$	$(Oi-Ei)^2/Ei$
0.1 - 1.0	60	25.5	44.5	1980.25	77.16
1.1 - 2.0	27	25.5	1.5	2.25	0.09
2.1 - 3.0	13	25.5	-21.5	462.25	18.12
3.0 and above	2	25.5	24.5	600-28	23.54
Total	102	102			

Source: Authors computation, 2021

The percentile value chi-square table of distribution revealed that, the critical value of X^2 at 0.05 (95%) level of significance for 3 degree of freedom is 7.81, which is less than the calculated chi-square value of

119.41.Farmers farm size influences their perception of climate change on yam yield in the study area, since the calculated chi-square value of 119.41 is greater than the chi-square critical value of 7.81.

Table 3.3: Years of farming experience and perception of climate change on yam yield

Years of farming experience	Observed frequency	Expected frequency	Oi -Ei	$(O-Ei)^2$	$(Oi-Ei)^2/Ei$
5 – 10	31	20/4	10.6	112.36	5.51
11 – 15	43	20.4	22.6	51.76	25.05
16 – 20	14	20.4	-6.4	40.96	2.01
21 – 25	11	20.4	-9..4	88.36	4.33
25 – above	3	20.4	-17.4	302.76	14.84
Total	102	102			

Source: Authors computation, 2021.

The table of percentile values for the chi-square distribution shows that, the critical value of X^2 at 0.05 (95%) level of significance for 4 degrees of freedom is 9.49. Since our calculated value of 51.73 is greater than the critical X^2 value of 9.49, it can therefore be said that years of farming experience influences farmer's perception of climate change on yam yield in the study area.

The table 3.4 shows computed changes of the climatic events in the study area.

Table 3.4: Observed and percentage table on changes in climate events

Factors	Increase	Decrease	Same	Undecided	Increase (%)	Decrease (%)	Same (%)	Undecided (%)
Rainfall	79	5	15	3	77.45%	4.9%	14.71%	2.94%
Temperature	45	10	32	15	44.12%	9.80%	31.37%	14.71%
Solar radiation	16	10	24	52	15.69%	9.80%	23.55^	50.98%
Flooding	68	6	20	8	66.0%	5.88%	19.61%	8.84%
Leaching	64	3	24	11	62.75%	2.94%	23.52%	10.78%
Evaporation	41	21	25	15	40.10%	20.59%	24.50%	14.70%

Sources: Authors computation, 2021

The table 3.4, indicates different changes farmer observed in climatic events, in the study area. Out of 102 respondents, 77.45% believed that rainfall has increased, 4.90% believed that it decreased, 24.71% believed that it's the same and 2.94% responded undecided. 44.12% agreed that temperature has increased. 9.80% believed it has decreased, 31.37% believed it's the same while 14.7 responded undecided.15.69% think solar radiation has increased, 9.80% believed it has decreased, 23.53% responded same while 50.98% responded undecided. 66.6% of respondents believed that flooding has increased, 5.88% believed that it has decreased, 19.61% responded same while 7.84% responded undecided. 62.75% responded to increase in leaching, 2.94% believed it has decreased, 23.53% believed it's the same while 10.78% responded undecided. 40.10% believe evaporation increased, 20.59% think it decreased, 24.50% responded it's the same while 14.70% responded undecided. The block diagram shows responses on observed and percentage changes in climate events.

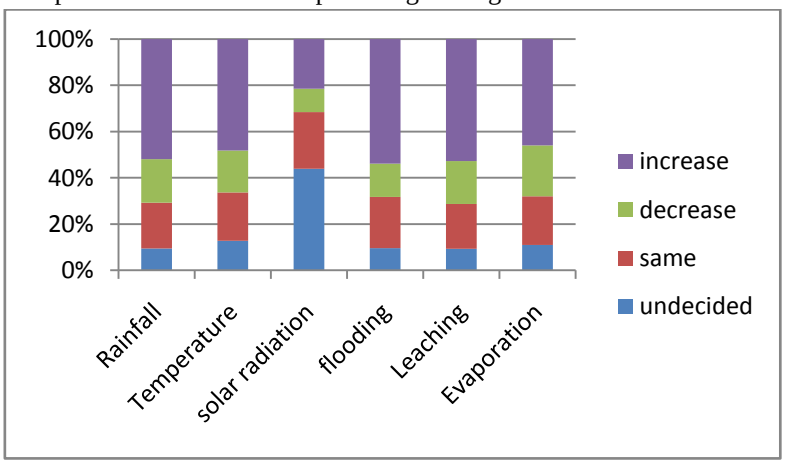

Figure 3.1: Observed changes in climatic events

Table 3.5: Farmer's perceived effects of climate change on yam yield

Perceived effect of climate change in yam yield	Frequency	Percentage (%)
Changes in climate elements affects planting time and makes planting difficult	75	73.5
Variation in rainfall pattern have effect on yam in terms of growths and germination	78	76.5
Climate change leads to more use of organic fertilizer in improving and conserving soil structure	70	68.6
Unpredictable weather changes favour diseases prevalence which affects crop sustainability	82	80.4
Low yield and stiffed growth of yam as a result of excess rainfall and temperature	80	78.4
Changes in weather pattern leads to unpredictable time for yam planting season	77	75.5
Climate change has increased cost of yam production	69	67.6

Sources: Authors computation, 2021.

The table 3.5 shows, percentage of the different ways farmers in the study area perceive the impact of climate change on yam production. 80.4% of the respondents which is the highest perceived the impact of climate change as, unpredictable weather pattern which favors diseases prevalence and affects crop, 78.4% perceived effect of climate as low yield and stunted growth of yam due o excess rainfall and temperature. 76.5% perceived variations in rainfall pattern as effects of climate change on growth and germination of yam. 75.5% perceive changes in weather pattern which leads to unpredictable time for yam planting season. 73.5% of the respondents perceived the impact of climate change as changes in climate element which affects plating time and making placing difficult. 68.6% perceive climate changes as changes which leads to more use of organic fertilizers in improving and conserving soil structure as impacts of climate change. While 67.6% perceive increased cost of yam as impact of climate on yam production in the study area.

4. Conclusion

This study has examined farmer's perception of climate change effect on yam yield in Ehime Mbano local government area of Imo Ste Nigeria. We were able to ascertain that farmers have a high perception of the effects of climate change on yam yield in the study area. The farmer's socio-economic characteristics and extent to which perception is influenced by some farmer's socio-economic state shows that, educational level influences farmer's perception of climate change on yam yield at 5.99 X^2 critical value and 37.294 calculated X^2 value. Farmers farm size influence their perception of climate change on yam yield at 7.81 critical chi-square value and 119.41 calculated chi-square value. Results also shows that, years of farming experience influences farmer's perception of climate change on yam yield in the study are at 9.49 critical ch-square value and 51.73 calculated chi-square value. Also on different changes farmer observed in climatic events, in the study area out of 102 respondents, 77.45% believed that rainfall has increased. 44.12% agreed that temperature has increased while 9.80% believed it has decreased. 15.69% believe solar radiation has increased, 66.6% of respondents believed that flooding has increased while 5.88% believed that it has decreased. 40.10% believe evaporation. 62.75% responded to increase in leaching, 2.94% believed it has decreased, 23.53% believed it's the same while 10.78% responded undecided to any changes. The highest proportion (80.4%) perceived effect of climate change as unpredictable weather changes which favors diseases prevalence and affects crop sustainability, 79.4% perceived effect of climate change as low yield and stunted growth of yam as a result excess rainfall and temperature. 76.5% perceived effects of climate change as variation in rainfall pattern which have effect on yam in terms of growth and germination. 75.5% perceived effects of climate change as changes in weather pattern, which leads to unpredictable time for yam planting season. 73.5% perceived effect of climate change as changes in climate elements which affect planting time and makes planting difficult. This report is in agreement with Odweumi *et al.,* [1], that farmers in Ibadan are aware of the impact of climate change and their perception of climate change determines their adaptation strategy. It is recommended that the following points be taking into

consideration. Treatments of seedling with fungicides before sowing, Different planting dates to help combat the effects of climate change on yam yield should be adopted, Application of soil amendments should be adopted, Assistance of government in terms of supply of improved varieties of yam seedling is necessary. Also more education and awareness programs on good agricultural practices which will enhance increase in productivity in line with climate change should be up seated to reach many farmers.

Competing Interest

Authors have declared that no competing interest exists.

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