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Perceptions of Climate Change and Adaptation Strategies among Small-holder Cassava Farmers in Rural Communities of Bende L.G.A, Abia State, Nigeria

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Abstract

This study aimed to investigate the perceptions of climate change on cassava farming in two rural communities, Umu-imenyi and Umuhu-Ezechi, in Bende L.G.A of Abia State, Nigeria. A multistage random sampling technique was used to select a sample of 80 farmers (40 male and 40 female) from the two communities. The study used primary data sources, such as an interview schedule and questionnaire, which were administered offline using the Open Data Kit (ODK) Collect app on an android phone by trained enumerators. Results revealed that majority of the respondents were aware of climate change and its effects on their farming activities. However, majority had limited access to extension services. The study therefore recommends providing farmers with adequate extension services and support, conducting research to understand the impact of climate change on other regions, promoting climate-smart agriculture techniques, implementing policies that support sustainable and resilient agricultural practices and systems, and provision of financial and technical support to farmers to help them adapt to changing climate conditions.

Keywords: Climate change, Cassava farming, Perceptions, Adaptation and Extension services

Introduction

International Institute for Tropical Agricultural report (IITA, 2004) noted that Cassava (Manihot species) is one of the most significant crops for food in the tropics and a staple food cultivated in Africa for human consumption, animal feed, and raw material for industries. The demand for starch and cassava-based raw materials has increased significantly due to rising prices of close substitutes like rice and maize, causing industries across the globe to rapidly reorder the dynamics of the cassava market in the tropics (Africa, Asia, and Latin America) (Market Research Future, 2020; Ikuemonisan *et al*., 2020). According to FAO (2010), the cassava root is very rich in starch and contains a significant amount of calcium (50mg/100mg), phosphorus (40mg/100g), and vitamin (25mg/100g) but very low amounts of protein.

In Nigeria, the impact of climate change is becoming more intense, as there is an increase in flooding, drought, and general rainfall fluctuation experienced in the country in recent years. Specifically, in Root and Tuber Crops (RTCs) production, Ukonze (2012) identified many effects of climate change on RTCs (specifically cocoyam) production, ranging from reduction in nutritional value, taste, and quality to low yield. The climate is no longer predictable as in the past where rainy and dry seasons were succinctly separated. Unfortunately, most farmers still rely on the fluctuating climate signals for farming activities, resulting in heavy losses of planted crops. Nigerian Meteorological Agency (NIMET, 2012) stated that if the present trend of climate variability continues, it is likely that the frequency and intensity of weather-related disasters may increase in the years ahead. Observations have shown that the climate variability trend has continued to progress over the years. This highlights the urgent need to develop effective and sustainable mitigation and adaptation measures in the country. Although Nigeria, like other developing countries, is not required under the current global climate change negotiations to take on emission reduction commitments (mitigation), it nevertheless has to adapt to the expected impacts of anticipated climate change (Oladipo, 2010). This makes adaptation the major response to climate change in Nigeria. Different researchers in different parts of the country have identified varying adaptation options, as well as those developed by farmers through experience over the years.

Eriksen *et al*. (2010) noted that though adaptation can significantly minimize the undesirable impacts of climate change, enough attention is yet to be paid to the outcome of these adaptation practices as regards sustainability. They explained that in some cases, what seems to be a successful adaptation strategy to climate change may, in fact, undermine the social, economic, and environmental objectives associated with sustainable development. For instance, strategies or policies that make sense from one perspective, or for one group, may at the same time reduce the livelihood viability or resource access of other groups. Likewise, an eagerness to reduce climate risk through specific technologies or infrastructural changes may sometimes lead to the neglect of other environmental concerns, such as biodiversity. Hence, adaptation can have unintended negative effects both on people and on the environment (Næss *et al*., 2005; Eriksen and O'Brien, 2007; Eriksen and Lind, 2009).

There are varieties of cassava that are known for their high tolerance and ability to adapt to a wide range of ecological conditions and changes in climate. These varieties can perform relatively well compared to other crops in terms of yield (Otekunrin and Sawicka, 2019). This quality confers on cassava a reliable food security for farming households in the tropics (Ikuemonisan *et al*., 2020), and further provides dietary energy for close to a billion people and livelihoods for millions of farmers/processors, traders worldwide (FAO, 2018; Ikuemonisan *et al*., 2020). Africa is the largest producer of cassava in the world, accounting for 62% of global production (Sanni *et al*., 2009). Within Africa, Nigeria is the leading producer, with an annual output of 38.3 million tons, which represents about two-thirds of Africa's total cassava production. Cassava is a significant crop in Nigeria, providing both a subsistence crop for households and a commodity for commercial use, and plays an important role in the well-being of the Nigerian population.

Climate of a region is determined by the weather conditions and its meteorological factors over a long period of between 30 to 40 years. This is different from weather, which is the atmospheric condition within a very short period of time of at most two weeks. The classical period as determined by the World Meteorological Organization is 30 years during which a number of changes in the variables that determine the predominant climatic pattern in the regions are known. The climatic elements include; rainfall, temperature, sunshine intensity, relative humidity, atmospheric pressure, cloud cover, snow, dew, frost, and wind. Cassava is known for its ability to grow on marginal lands, but to achieve high yield and productivity, it requires moderate climatic conditions and optimal soil properties like light, sandy loam soil of medium fertility with good aeration and drainage. However, extreme weather events such as prolonged drought or heavy rainfall leading to floods can negatively impact the output of cassava. (Akanbi *et al*., 2004). Hence, This study aimed to investigate the perceptions of climate change on cassava farming in two rural communities, Umu-imenyi and Umuhu-Ezechi, in Bende L.G.A of Abia State, Nigeria.

Methodology

Study Area

The study was conducted in Umu-imenyi and Umuhu-Ezechi communities in Bende L.G.A of Abia State, Nigeria. Umu-imenyi and Umuhu-Ezechi are rural communities located in Bende. Bende L. G. A. is situated on latitude 5.65 North and longitude 7.65 East, at an altitude of 91.00m/298.56ft. Agriculture is the main occupation of the majority living in the community, with cassava farming being the primary source of livelihood for the residents. The community is predominantly occupied by cassava farmers. The climate is characterized by a wet and dry season, with the wet season being warm, oppressive, and overcast and the dry season hot, muggy, and mostly cloudy. Over the course of the year, the temperature typically varies from 19.4°C to 30.6°C and is rarely below 15.6°C or above 32.2°C. The weather and climate conditions greatly affect the growth and yield of cassava, which implies that the major sector affected by changing climate is agriculture. The impact of climate change has the potential to hinder cassava farmers' capacity to secure their livelihoods and pose a challenge to the farmers. These challenges include increased poverty and food insecurity. This makes it an ideal location for this type of study.

Method of Data Collection and Analysis

The sample size for the study was determined using a multistage random sampling technique, which involved two stages. In the first stage, two communities were randomly selected from Bende L. G. A., giving a total of eight communities. In the second stage, 40 (20 male and 20 female) farmers were randomly selected from each of the two communities, giving a sample size of 80 respondents (40 male and 40 female) for the study. The data was collected using primary sources, such as an interview schedule and questionnaire, which were administered offline using the Open Data Kit (ODK) Collect app installed on an android phone by trained enumerators. ODK was chosen for its open-source, offline solution, real-time data transfer, increased accuracy, flexibility, data security, cost-effectiveness, ease of data management, increased efficiency, and better data visualization. The collected data was then cleaned and analyzed using Microsoft Excel 2016 software. Descriptive statistics such as frequency distributions, percentages, means, and standard deviations were used to summarize the data. The results of the analysis were then presented in the form of tables and figures, and discussed in the context of the study. Overall, the use of multistage random sampling and primary data sources, together with the use of the ODK Collect app and Microsoft Excel 2016 software, ensured the reliability and validity of the data collected, and allowed for a thorough analysis of the research findings.

Results and Discussion

Socio-economic Characteristics of the Respondents

Table 1 presents a detailed breakdown of various demographic and socioeconomic factors for both male and female farmers. The variables include; age, education status, family size, farm size, marital status, membership in cooperatives, farming experience, access to extension services, and average income level. Result shows that the majority of both males and females were within 51-60 age range, with 40% of males and 50% of females in this range. The mean age for males is 42 and for females 49, indicating that on average, females are older than males. Majority of both males and females have secondary education, with 30% of males and 27.5% of females in this category. Similarly, majority of both males and females have family sizes between 1-4 and 4-8 persons, with 37.5% of males and 30% of females in the first category and 45% of males and 50% of females in the second category. The mean family size for males is 6 and for females 7. Farm size data shows that the majority of females have small farms (<2 hectares) with a mean of 3.8ha, while majority of males have farms between 2-4 hectares with a mean of 5.9ha. Marital status data shows that majority of both males and females are married, with 57.5% of males and 47.5% of females in this category. Majority of both males and females have farming experience between 11-20 years, with 30% of males and 32.5% of females in this category. The mean farming experience for males is 15 years and for females 13 years. Majority of individuals have no access to extension services and have average income level between 101000-150000 Naira. Overall, the data suggests that there are some similarities in demographic and socioeconomic factors between males and females, but there are also some notable differences, particularly in terms of age, farm size, and average income level.

Farmer perceived effect of climate change on cassava yield

Climate change is believed to have affected crop cultivation and yield in a number of ways, such as through changes in average temperature, rainfall, and climate extremes, with an important impact on soil erosion (e.g., floods, droughts), pests and diseases, proliferation of weeds, and growing seasons (World Bank, 2008). Nigeria is still highly dependent on rainfall, making crop production entirely reliant on the uncontrolled environment. Abubakari and Abubakari (2015) confirmed that climate change pose a threat to agriculture and food security due to the loss of crops, through variations in rainfall and temperatures. Figure 1 presents the results of farmers' perceived effects of climate change on cassava yield. Majority of the respondents indicated that cassava yield has reduced, regardless of their educational level. They also noted that due to the irregular pattern of onset of rainfall, planting dates become uncertain, hence delaying the planting and harvesting dates of their cassava tubers.

Source of weather information

Table 2 results present the distribution of cassava farmers by source of information on weather. The results show that radio and television are the major sources of weather information, representing 86.7% and 90.0% for males and females respectively. This is followed by the internet (73.5% for males, 63.3% for females). Other significant sources are extension agents, research institutes, farmers' cooperatives and extension bulletins. While newspapers were the least, recording only 20.5% and 18.2% for males and females respectively. This agrees with the study of Farauta *et al*. (2011) that mass media has the tendency to reach a large audience at a faster rate. The implication of this finding is that there is a need for extension services to rise up to the challenge of information dissemination through mass media channels, especially regarding issues of climate change.

Mitigation and Adaptation Strategies to climate

Figure 3 presents the different mitigation and adaptation strategies adopted by cassava farmers. The results show that majority of males (87%) and females (90%) adopted mixed cropping as an adaptation strategy, followed by the application of pesticides. Male cassava farmers' preference of adaptation strategies are mixed cropping (87%), application of pesticides (87%), intensive use of fertilizer (86%), use of pest and disease-resistant varieties (85.6%), while the use of weather forecasts was the least adopted method. Female cassava farmers mainly adopted mixed cropping (90%), application of pesticides (84%), use of pest and disease-resistant varieties (82%), use of herbicides (82%), intensive use of fertilizer (81%), changes in the timing of land preparation activities, planting dates, and harvesting dates (81%), while tree planting (39%) is the least adopted by female cassava farmers. The low percentages for construction of drainages, irrigation practices, tree planting, and use of weather forecasts suggest that they are not considered major adaptation strategies in the study area by the farmers.

Conclusion

The study aimed to investigate the perceptions of climate change on cassava farming in Umu-imenyi and Umuhu-Ezechi communities in Bende L.G.A of Abia State, Nigeria. Results showed that majority of the farmers were aware of climate change and its effects on their farming activities, and had limited access to extension services. The study therefore recommends providing farmers with adequate extension services and support, conducting research to understand the impact of climate change on other regions, promoting climate-smart agriculture techniques, implementing policies that support sustainable and resilient agricultural practices and systems, and providing financial and technical support to farmers to help them adapt to changing climate conditions.

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Table 1: Socio-economic Characteristics of the Respondents (n=80)

Variables	Male		Female	
	Frequency	Percentage	Frequency	Percentage
Age (years)				
30-40	5	12.5	3	7.5
41-50	12	30	13	32.5
51-60	16	40	20	50
61 -70	7	17.5	4	10
Mean	42		49	
Education Status				
Non-formal	7	17.5	12	30
Primary	16	40	13	32.5
Secondary	12	30	11	27.5
Tertiary	5	12.5	4	10
Family Size				
1-4	15	37.5	12	30
4-8	18	45	20	50
9>	7	17.5	8	20
Mean	6		7	
Farm Size (hectares)				
< 2	7	17.5	19	47.5
2-4	12	30	11	27.5
5-7	17	42.5	8	20
8-10	4	10	3	7.5
Mean	5.9		3.8	
Marital Status				
Single	8	20	5	12.5
Married	23	57.5	19	47.5
Divorced	5	12.5	3	7.5
Widowed	4	10	13	32.5
Members of Cooperatives				
No	27	67.5	29	72.5
Yes	13	32.5	11	27.5
Farming Experience				
1-10	7	17.5	3	7.5
11-20	12	30	13	32.5
21-30	16	40	19	47.5
31-40	5	12.5	5	12.5
Mean	15		13	
Access to Extension Services				
No	28	70	32	80
Yes	12	30	8	20
Average Income Level				
50000-100000	3	7.5	13	32.5
101000-150000	16	40	11	27.5
151000-200000	13	32.5	12	30
>201000	8	20	4	10

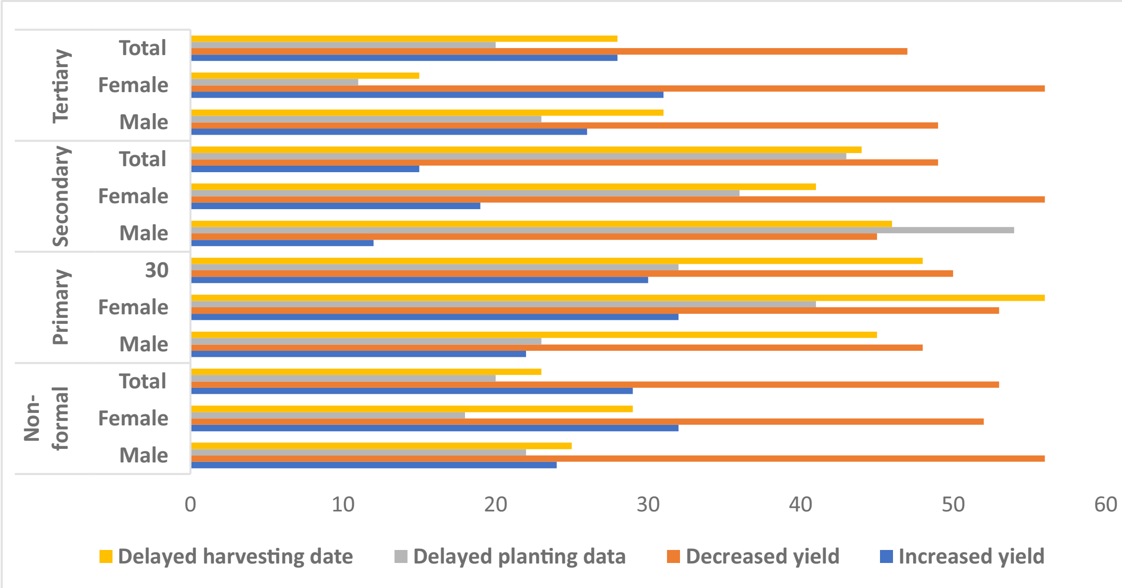

Fig. 1: Farmer perceived effect of climate change on cassava yield

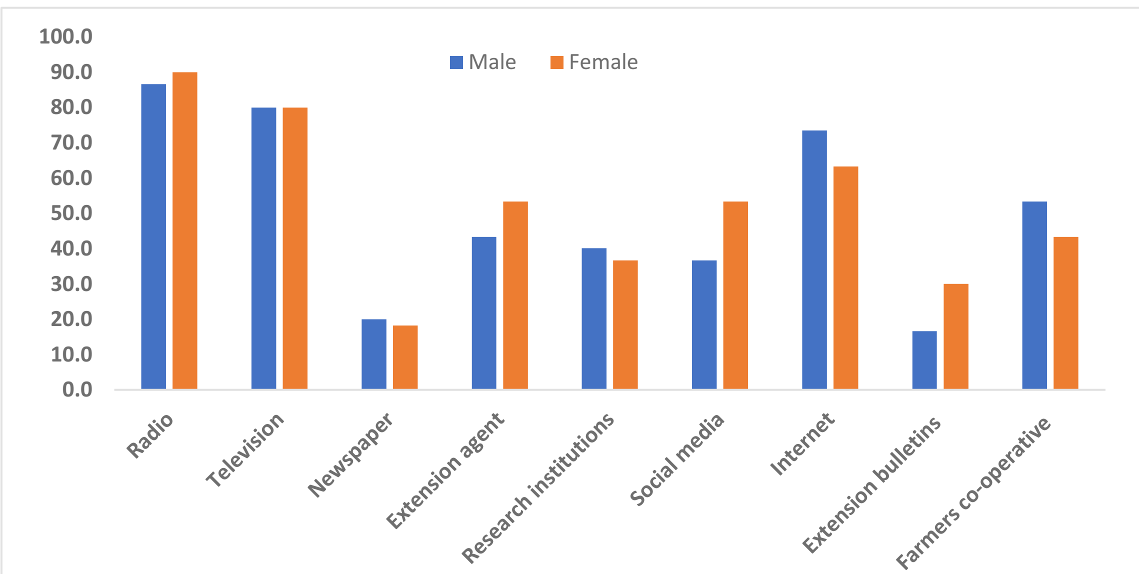

Fig. 2: Sources of weather information

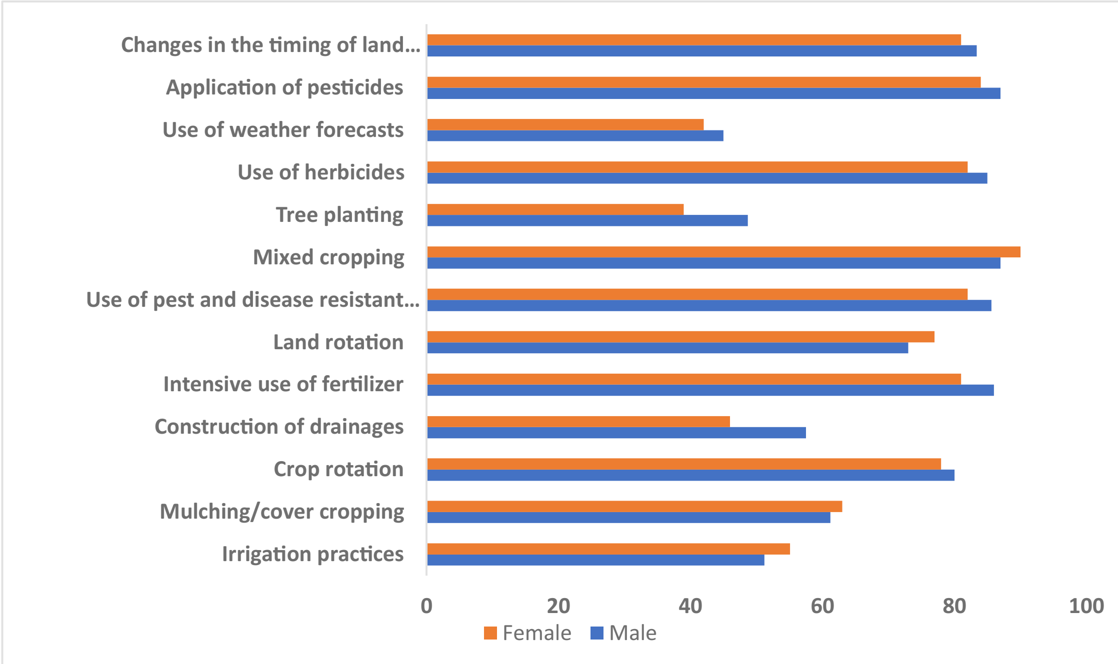

Fig. 3: mitigation and adaptation strategies adopted by cassava farmers.