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PERCEIVED EFFECT OF SOIL EROSION ON MAIZE PRODUCTION IN IMO STATE, NIGERIA

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ABSTRACT

This study analyzed the perceived effects of soil erosion on maize production in Imo State, Nigeria. Specifically, the study ascertained the causes of soil erosion as perceived by maize farmers; ascertained the perceived effects of soil erosion on maize farmers' production; identified the control measure used by maize farmers in coping with the effects of soil erosion on their production and identified constraints to the use of soil erosion control measures. A multistage sampling procedure was used in the selection of 180 maize farmers. Data were collected using structured questionnaire and were analyzed using descriptive statistical tools and Ordinary Least Square (OLS) regression analysis. Results showed that maize farmers perceived causes of soil erosion to include: excessive/heavy rainfall and flooding ($\bar{x}$ = 3.107), overgrazing (($\bar{x}$ = 2.96), deforestation/ destruction of vegetation ($\bar{x}$ = 2.80), blocked or poor drainage system ($\bar{x}$ = 2.77 among others. Farmers perceived the effects of soil erosion as decline in maize yield when soil erodes ($\bar{x}$ = 3.46); food insecurity and poverty ($\bar{x}$ = 3.22); reduction in land for agricultural activities ($\bar{x}$ = 3.32) among others. Maize farmers identified soil erosion control measure as filling the affected area with farm residue (86.67%), raising ridges to prevent water from running through to the farm (76.11%), building and structures should not obstruct water ways (68.33%), implementing cover crops, mulching, and cover crop (61.67%). Maize farmers were constrained to the use of soil control measure such as inadequate funding (78.89%), high cost of some erosion measures control (73.33%), lack of incentive from governments (70.00%), difficulty in acquiring land for forest establishment (68.89%). The result shows that age, marital status, level of education, household size, monthly farm income and extension contact influenced the maize farmers perceived effects of soil erosion on their maize production, these were significant at 1% probability level. The study concludes that there was prevalence of soil erosion in Imo and maize farmers were experiencing constrains in reducing soil erosion effects on their maize production. The study recommends among others that maize farmers should judiciously use their cooperative association by sharing relevant information in minimizing the effects of soil erosion on their farm land.

Keywords: Effects, soil erosion, maize production, measures

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INTRODUCTION

Maize, scientifically known as *Zea mays,* is the second most significant staple food globally, following rice. It holds tremendous socioeconomic significance in Sub-Saharan Africa. It is widely acknowledged as one of the longest-standing farmed food crops (Biswas et al., 2022; Elham et al., 2023) and a substantial provider of protein, minerals, carbohydrates, and vitamin B (Adeola et al., 2023). Maize farming is widespread in Nigeria and many places (Okorie et al., 2020). In Nigeria, maize holds significant importance as a grain in terms of the number of farmers involved in its production and its economic value (Okoroh & Ejike, 2019; Olasehinde et al., 2023). The cereal plant produces grains that can be prepared in numerous ways, such as cooking, roasting, frying, grinding, pounding, or crushing. These grains make food items, including pap, *'tuwo,*' *'gwate*', *'dokunnu*,' and many more (Ta'awu et al., 2023).

Belete (2020) and Inbathamizhan and Kumar (2023) have stated that maize has many applications. The grain, leaves, stalk, tassel, and cob possess the potential to yield a diverse range of food and non-food commodities (Adegbite et al., 2023). Maize is the second most crucial staple grain globally (Santpoort, 2020). Over time, maize has served not only as a food supply for humans and cattle but also as a means of generating money and foreign currency(Osundare, 2017). Abdulle et al.'s (2022) study highlighted the expanding significance of the crop in Nigeria, as food processing businesses and livestock feed mills are increasingly using it. The global demand for maize crops is expected to increase from 382 million tonnes in 2010 to 704 million tonnes in 2030, primarily in emerging nations (Pingali & Pandey, 2023). Consequently, there is an anticipation of a rise in maize crop production among farmers to satisfy the worldwide demand. The demand for maize occasionally exceeds the supply due to the diverse home applications (Pingali & Pandey, 2023). The demand for maize in Nigeria is proliferating daily. This phenomenon may be attributed to the use of grain for the purpose of nourishing poultry and its role as the primary source of sustenance for numerous households (Ogunniyi, 2011). In Nigeria, the maize cultivation covers a land area of over 2.5 million hectares, and the expected yield is approximately 1.4 metric tonnes per hectare (Ogundari, 2006). Paradoxically, the utilization of maize for different home purposes reveals that the domestic requirement of 3.5 million metric tonnes exceeds the production supply of two million metric tonnes. Soil erosion poses a significant obstacle to the production of maize crops (Simanjuntak et al., 2023). Soil erosion poses a significant threat to soil fertility and production by depleting organic matter and essential nutrients, and impeding vegetation growth, hence adversely impacting total biodiversity (Abdulle et al., 2022). Soil erosion alters soil properties, including its physical, chemical, and biological features. This can result in a decrease in the potential productivity of agriculture and raises worries about the cost of production and food security, particularly in light of an increasing global population (Šarapatka & Bednář, 2021).

The term "Soil Erosion" refers to a significant global process where rock fragments and soils are gradually washed away and separated from their original locations. These materials are then transported and eventually deposited in new areas through the actions of humans, animals, wind,

and water (Nigeria Erosion and Watershed Management Project (NEWMAP), 2022). Soil erosion is the process by which the land surface is gradually eroded and removed by various physical forces such as rainfall, flowing water, wind, ice, temperature change, gravity, or other natural or human-caused factors. This erosion causes soil or geological material to be detached and transported from one area to another on the Earth's surface (European Union Commission of Land Management and Natural Hazards (EUCLMNH), 2023). Bizi and Sidi (2023) stated that soil erosion refers to the deliberate loss of soil and plant nutrients from the land surface by different denudation processes. Soil erosion is acknowledged as a significant global issue in both environmental and agricultural contexts, according to the United Nations Environment Programme (UNEP) in 2023. According to the World Food Programme (WFP) in 2023, soil erosion is responsible for almost 80% of the present degradation of agricultural land worldwide. Soil erosion is the primary form of soil degradation in agricultural areas globally, as identified by the Food and Agricultural Organization (FAO) and the United Nations Environmental Programme (UNEP) in 2023.

According to Mandal et al. (2023), it causes significant environmental damage and substantial economic losses. In Nigeria, specifically in Imo State, the soil has seen significant erosion and has been categorized as structurally unstable for agricultural purposes (NEWMAP, 2022; Ominikari & Nimiye, 2023). Multiple causes contribute to the escalating incidence of soil erosion in Imo State. Okorie et al. (2020) and Bassey (2023) identified several factors that contribute to the problem. These factors include the growing population density, soil characteristics, rainfall patterns, sand mining activities, deforestation,blockage of drainages, inadequate water runoff management, and unsustainable agricultural practices. Agricultural producers are currently experiencing a decline in productivity, which adversely affects both the overall yield and the caliber and quantity of crops that future generations can cultivate (Ersek, 2023).

Soil erosion has emerged as a significant concern for governments and individuals worldwide, including Nigeria (NEWMAP, 2022; UNEP, 2023; World Bank, 2023). The establishment of the Nigeria Erosion and Watershed Management Project (NEWMAP) in 2013, funded by the World Bank, aims to rehabilitate degraded lands and reduce vulnerability to soil erosion. This effort by the Federal Government indicates a growing inclusiveness in the fight against soil erosion, particularly in Imo State, Nigeria. Soil erosion has significant environmental consequences and causes substantial economic and livelihood damage to agricultural output (Aniah et al., 2013). Soil erosion typically results in the loss of agricultural land, reduced soil fertility, and varying degrees of damage to farm buildings and structures. Furthermore, it has escalated the expenses and duration required for transporting agricultural goods to local markets, rendering agricultural endeavours unappealing, particularly to the younger generation. The efforts to establish a network among maize farmers in Imo State and facilitate their access to urban and rural markets for efficient transportation of maize produce and inputs are being significantly hindered by soil erosion, which has totally blocked off most rural roads. Soil erosion typically results in the loss

of agricultural land, a decline in soil fertility, and varying degrees of damage to farm buildings and structures. The efforts to establish a network among maize farmers in Imo State and facilitate their access to urban and rural markets for efficient transportation of maize produce and inputs are facing significant obstacles due to extensive soil erosion, which has wholly severed many rural roads. Hence, it is imperative to tackle this threat as it greatly impacts maize production, particularly affecting farmers who heavily rely on soil productivity for their sustenance. They engage in multiple agricultural practices to cultivate maize primarily to meet the diverse human requirements, including food, income, and other commodities. Hence, comprehending the farmers' perceived effect of soil erosion on maize production in Imo State is crucial for mitigating the consequences of soil erosion on maize production.

This research aims to examine farmers' perception of soil erosion and its effect on maize production in Imo State. The objective is to gain valuable insights that can be used to develop effective soil conservation strategies and enhance maize production in response to the environmental challenge of soil erosion. Consequently, this results in a need for more knowledge.

Therefore, examining the perceived effect of soil erosion on maize production in Imo State, Nigeria is necessary. The objectives of this study were to describe the socioeconomic characteristics of maize farmers, determine the perceived causes of soil erosion among maize farmers, evaluate the perceived effect of soil erosion on maize farmers' production, identify the strategies employed by maize farmers to mitigate the effects of soil erosion on their production, and identify the challenges faced in implementing soil erosion control measures.

The study's hypothesis posits that there is no significant relationship between the socioeconomic characteristics of maize farmers and their perception of the effect of soil erosion on maize production in the designated region.

METHODOLOGY

The research was conducted in Imo State, Nigeria. Imo State is situated in the eastern region of Nigeria. The State is situated within the latitudes of 4°45'N and 7°15'N, and the longitudes of 6°50'E and 7°25'E, according to the Nigerian Meteorological Agency (NiMET), 2020. The soil is abundant in essential nutrients for cultivating arable crops such as cassava, maize, yam, cocoyam, okra, pumpkin, and others.

The study sample consisted of maize farmers from the study area. The study employed a multistage sampling process to determine the sample size. The researchers employed purposive sampling to specifically choose regions characterized by a high degree of soil erosion. Purposive selection was employed to choose six (6) Local Government Areas (LGAs) from each agricultural zone (Owerri, Orlu and Okigwe) in Imo State, where soil erosion is widespread. This resulted in a total of eighteen (18) LGAs. This is intended to document regions exhibiting a

significant degree of soil erosion. For the second stage, one community each was intentionally selected from the18LGAs to include erodible soil, resulting in a total of eighteen (18) communities. Ultimately, one-hundred and eighty (180) maize farmers were chosen for the study. Ten (10) farmers were randomly picked from each of the eighteen (18) communities.

Questionnaires were utilized to gather data. The objectives (i), (iv), and (vi) were achieved using descriptive statistical methods such as frequency distribution, percentages, and mean ($\bar{x}$). The objectives (ii) and (iii) were accomplished by analyzing the mean scores and standard deviation. This analysis was conducted using a 4-point Likert-type scale rating model, where SA represents "Strongly Agreed" (4), A represents "Agreed" (3), D represents "Disagreed" (2), and SD represents "Strongly Disagreed" (1). The scores were summed and divided by the number of scales to obtain a discriminating index of 2.50 (4+3+2+1)/4 = 2.50) for the causes and effects of soil erosion, as perceived by maize farmers.

According to the perception of maize farmers, the decision rule states that any variable equal to or greater than 2.50 will be recognized and considered as a cause of soil erosion. Variables below this threshold will not be accepted. A similar approach was also taken for the perceived effect. Ordinary least square (OLS) multiple regression was employed to test the null hypothesis. The model is explicitly expressed in the following form:

The variable Y is represented by a set of values (X_1, X_2, X_4, X_5, X_6, X_7, X_8, ei).

The variable Y represents the total evaluation score of maize farmers' perception of the effect of soil erosion on maize production.
X_1 = Age (years)
X_2 = Sex (Male = 1, Female = 0)
X_3 = Educational level (Number of years spent in school)
X_4 = Household size (Number of persons)
X_5 = Monthly Farm income (Naira)
X_6 = Farm Size (Hectare)
X_7 = Membership of cooperative (member = 1, non-member = 0)
X_8= Extension contact (Number of visits)
X_8= Farming Experience (Years)
e_i = error term

RESULTS AND DISCUSSION

Socio-economic characteristics of maize farmers in Imo State

The findings of the socioeconomic characteristics of maize farmers in Imo State are displayed in Table 1. The average age of the maize farmers was 42.33 years. This suggests that the maize farmers engaged in maize production were still in their prime, displaying energy and enthusiasm in their maize farming activities. This outcome aligns with the research conducted by Echendu

(2022), which revealed a significant proportion of middle-aged individuals engaging in farming activities. This suggests that most maize farmers are mature, highly skilled, and capable of making meaningful contributions to maize production.

Furthermore, most (60.56%) maize growers were female and married (85.00%). This suggests that both males and females participated in maize cultivation, although there were a higher proportion of females in the area. The outcome aligns with the discoveries of Uduji and Okolo-Obasi (2022), who documented that females comprise the majority of individuals engaged in agricultural production. Nevertheless, this discovery contradicts the findings of Egbetokun et al. (2014), who observed a higher participation of males in maize cultivation than women in their study. Consistent with the research conducted by Yusuf et al. (2022), most farmers engaged in agricultural operations were married.

The data presented in Table 1 indicates that a majority (51.11%) of maize farmers possessed secondary education, 30.00% had tertiary education, 27.22% had primary education, and 2.78% had no formal education. The finding suggests that the maize farmers in the study area possessed literacy skills and were able to recognize the effect of erosion on their maize yield. Consequently, increased education levels will considerably affect maize farmers' participation in maize production in the region. The data aligns with the conclusion of Jonathan et al. (2020), who argued that higher education has a favourable effect on farmers' decision-making and enhances their comprehension of erosion coping measures, leading to considerable improvements in their livelihood activities, income and standard of life. The average household size was seven individuals. The finding suggests that rural maize producers in the research area had many household members available to provide labour for maize production. Approximately 45% of the participants possessed land areas ranging from 0.1 to 1.0 hectares. The tiny size of this farm might also be linked to the area's prevalence of land tenure and urbanization. Farmers with more extensive land holdings are more inclined to implement a more significant number of effective erosion control measures compared to those with smaller land holdings.

Similarly, a farmer may employ multiple coping mechanisms, but the limited area of their property can be a substantial obstacle. The study corroborates the findings of Nkwunonwo (2020), which indicate that a larger farm size positively influences farmers' adoption of enhanced coping mechanisms. The average monthly income was N35,424.74. Farmers with a higher monthly income are anticipated to implement more soil erosion control measures than those with a lower farm income. According to Echendu's (2022) research, farmers who have higher revenue from their farms are more likely to make informed decisions, use essential resources to enhance their livelihood activities, and effectively manage soil erosion on their farms. Approximately 60% of the farmers lacked access to credit facilities, while the remaining 40% had such access. Agricultural financing is crucial for the advancement of agriculture. Credit is vital in alleviating maize farmers' financial limitations, enabling them to participate in agricultural activities, enhance production, and adopt improved technology. Ensuring widespread access to financing is crucial for enhancing the quality and quantity of agricultural goods. Most maize farmers

(86.67%) were affiliated with a co-operative, and a significant proportion (56%) had access to extension services. The findings suggest that being a co-operative organization member can impact the economic performance of its members and the sharing of information regarding the use and implementation of more effective soil erosion control techniques in the region. The results are corroborated by the findings of Olagunju et al. (2021), which indicate that farmers who are affiliated with co-operative societies enjoy advantages in terms of negotiating power, the exchange of knowledge, and the collective provision of farm goods and labour, as well as economies of scale. The mean duration of experience in maize cultivation was 8.25 years. This indicates that the maize farmers possessed considerable expertise, which will improve their accurate understanding of soil erosion's effect on their maize production in the research area. Farmers gain exposure to various adaptation techniques through experience, which helps them offset the negative impacts of soil erosion on maize production.

Causes of soil erosion as Perceived by maize farmers in Imo State

Table 2 lists the findings of the causes that maize farmers in Imo State reported as contributing to soil erosion. The study revealed that maize farmers identified excessive/heavy rainfall and flooding ($\bar{x}$ = 3.10), unsustainable agricultural practices ($\bar{x}$ = 3.10), overgrazing ($\bar{x}$ = 2.96), deforestation ($\bar{x}$ = 2.80), continuous cropping ($\bar{x}$ = 2.80), blocked or poor drainage system ($\bar{x}$ = 2.77), improper tillage and ridge making ($\bar{x}$ = 2.71), and slope steepness ($\bar{x}$ = 2.62) as the leading causes of soil erosion. These causes were rated highly and contributed significantly to the overall discriminatory score. Unsustainable agricultural practices, such as bush burning, which is the indiscriminate use of fire to clear vegetation on land for cultivation. This practice leaves the soil barren and vulnerable to erosion. Certain regions in Imo State lack a proper drainage system, and even in areas where they exist, debris frequently obstructs them. This obstruction leads to water overflowing onto the ground surface, resulting in the erosion of soil nutrients.

The findings align with the perspectives of Enwelu and Okeke (2023) and Ominikari and Nimiye (2023), who assert that soil erosion primarily occurs due to road construction lacking proper safe side drains or any drains. Additionally, it is caused by unwise channelization of runoff, particularly in urban areas, and the indiscriminate destruction of vegetation cover or irresponsible selective removal of plant species, whether through activities such as bush burning, lumbering, fuel wood collection, establishment of construction sites, or other similar actions. This outcome suggests that maize farmers accurately identified the factors contributing to soil erosion, which has a detrimental impact on their crop yield and has the potential to influence their overall quality of life adversely. Ultimately, based on the average value ($\bar{x}$ = 2.70), which is higher than the threshold score ($\bar{x}\geq 2.50$), it indicates that the farmers accurately identified the factors contributing to soil erosion in the research location.

Perceived effects of soil erosion on maize farmers' production in Imo State

The findings regarding the effect of soil erosion on maize production in the study area are presented in Table 3. The result indicates a decrease in maize production (mean = 3.46) when

soil erosion occurs. Maize farmers consider the disappearance of topsoil and nutrients (mean = 3.30) as the main effect of soil erosion. Soil erosion can diminish maize yields by depleting nutrients, organic matter, and topsoil. Soil erosion leads to the loss of topsoil and the nutrients and organic matter it contains, ultimately leading to a decrease in maize yields. This corroborates the conclusions of Nasir-Ahmad et al. (2023) that soil erosion significantly affects farmers, resulting in a substantial decrease in their agricultural yield.

Soil erosion leads to an increase in soil compaction (mean = 2.80). When soil erodes, it causes damage to the soil structure, which in turn results in soil compaction. This compaction makes it more difficult for plant roots to penetrate the soil and receive essential nutrients and water. These conditions can inhibit plant growth and decrease crop production (Ersek, 2023). Maize farmers have observed that soil erosion directly impacts the uneven growth of maize (mean = 3.05). This is because soil erosion can damage different field sections to varying degrees, resulting in uneven crop growth. The topography of the soil can influence the movement of water and wind, leading to irregular erosion patterns that result in variances in crop growth, areas of crop loss, and places that cannot be cultivated.

The findings indicate an increase in potential input costs (mean = 2.62) and the use of fertilizer and pesticides (mean = 1.82). Farmers may be required to increase the use of fertilizer and other inputs in order to offset the decline in soil health quality. The maize farmers observed that soil erosion had the following impacts: a decrease in water quality, an increase in flooding (mean = 3.16), food insecurity and poverty (mean = 3.22), a loss in available land for agricultural activities (mean = 3.32), a decrease in farmers' income (mean = 3.30). This finding suggests that soil erosion significantly impacts maize farmers, leading to a detrimental influence on their maize production in the research area. The soil erosion in Imo State poses a significant threat to soil productivity, sustainable food production, and food security. This result is consistent with studies by Nwobodo et al. (2018), Ufot et al. (2016), and Yusuf et al. (2023), which concluded that soil erosion has a negative impact on crop production and decreases both the quality and quantity of food produced.

Control measure used by maize farmers in coping with the effects of soil erosion on their production

Table 4 presents the results of different soil erosion control methods employed by maize farmers to mitigate the effect of soil erosion on their maize crops. The findings revealed that the maize farmers identified several effective measures to address the issue. These included filling the affected area with farm residue (86.67%), implementing crop rotation (86.67%), raising ridges to prevent water from running through to the farm (76.11%), adopting reduced or no-till agriculture methods (74.44%), ensuring that buildings and structures do not obstruct waterways (68.33%), implementing cover crops, mulching, and cover crop techniques (61.67%), establishing buffer strips (56.11%), planting local fences across the land (55.56%), terracing (55.00%), practicing contour farming and strip planting (53.89%), improving the drainage system by properly

channeling rainwater (50.56%), and creating physical barriers to absorb wind and water, as well as gathering sands and stones around the cultivated land (74.44%).

Ojo et al. (2023) found that a higher percentage of agricultural households with limited acreage and inadequate management practices may overuse their property, resulting in erosion. According to Emeh and Igwe (2017), crop rotation has significantly decreased soil erosion caused by water. Additionally, the practice of cover cropping is beneficial for soil fertility management, soil quality improvement, soil water retention, enhancement of soil biodiversity and wildlife, as well as for controlling weeds, pests, and diseases (Abdulle et al., 2023). This issue may worsen, especially if the uneducated farmers need more control techniques.

Constraints to the use of soil erosion control measures

The data regarding the constraints to the implementation of soil erosion control measures is displayed in Table 5. The main problems that maize farmers have identified are not having enough money (ranked first with 78.89%), having to pay a lot to stop soil erosion (73.33%), not having any government incentives (70.00%), having trouble getting land to plant forests (68.89%), not having sound information systems (56.11%), and having to do much work to run the farms (55.56%). Enwelu and Okeke (2023) have provided evidence that highlights the challenges experienced by farmers in implementing soil erosion control techniques, including the high cost of these measures, insufficient finance, and a lack of support and motivation from governments. According to Obi and Okekeugbo (2017), the predominant form of soil erosion in Imo State is gullies, which are quite deep and require significant financial resources to mitigate their effect on farmers.

Relationship between Maize Farmers Socio-economic Characteristics and Perceived Effects of soil erosion on maize production

The study examines the relationship between the socioeconomic characteristics of maize farmers and their perception of the effect of soil erosion on maize production. These findings are presented in Table 6. A multiple regression analysis using Ordinary Least Squares (OLS) was conducted in four different functional forms: linear, semi-log, double-log, and exponential. The double log regression function was selected as the primary equation due to its high statistical significance of the coefficients and goodness of fit. This function yielded the highest R^2 value (0.817), F-ratio value (14.440), and conformity of the signs with the model's expected outcomes. Additionally, it included the greatest number of significant explanatory variables.

The coefficient of multiple determinations (R^2) was determined to be 81.70% and exhibited statistical significance at a 1% level of probability. Therefore, it can be inferred that the socioeconomic characteristics of maize farmers substantially affected their perception of the effects of soil erosion on maize production in the region. Additionally, the regression model demonstrates a powerful ability to explain the relationship. The marginal effect is outlined as follows:

The coefficient of age (X_1) was positively and significantly associated with the outcome variable at a 1% significance level. This suggests that as the age of the individuals grows, there is a notable rise in the perceived effect of soil erosion on maize production in the study region. This corroborates the conclusions of Bolarinwa et al. (2016) that there is a positive correlation between the age of the farmer and their level of understanding regarding eroding fields, surpassing that of their peers.

The marital status coefficient exhibited a positive and statistically significant relationship at a 1% significance level. Therefore, married farmers had a greater level of awareness regarding the impact of soil erosion on maize production in the region. Indeed, married farmers typically enjoy the advantages of having access to farm workers, shared knowledge, and financial resources from many business operations and extended family members. Married farmers in the area are more likely to accurately perceive soil erosion's impact on maize yield than single farmers. This discovery aligns with the research conducted by Bolarinwa et al. (2021), which suggests that married farmers are more likely to possess more access to agricultural resources, such as land, and benefit from a larger family size that can contribute to farm labour.

The educational level coefficient (X_4) had a statistically significant positive effect at a 1% probability level. This suggests that as the degree of education increases, there is a notable rise in the perceived effect of soil erosion on maize production in the region. Therefore, it can be inferred that farmers with a higher level of education possessed a greater understanding of the effect of soil erosion on maize production compared to their older counterparts in the region. The study aligns with the findings of Ewetola et al. (2021), which indicate that an enhanced level of education leads to favourable transformations in knowledge, attitude, and skills among farmers, facilitated by research and extension services.

The coefficient for household size (X_5) was positively and significantly significant at a 5% probability level. This suggests that when the size of households increases, there is a notable rise in the perceived effect of soil erosion on maize production in the region. This suggests that maize producers with larger households recognize the significance of employing family members as labour in maize production in the region. Implementing soil erosion control measures may require significant manual work. The discovery aligns with the outcome of Kehinde et al., (2021), which indicates that a substantial household size indicates abundant labour resources and agricultural growth.

The monthly farm income coefficient exhibited a positive and statistically significant relationship at a 1% probability level. This suggests that as the monthly farm income increases, there will be a notable rise in the region's perceived impact of soil erosion on maize production. The findings suggest that farmers with higher monthly farm incomes have more significant financial resources to implement various soil erosion control measures than their area counterparts. The study aligns with the findings of Yusuf et al. (2022), which indicate that farmers with higher farm income are more likely to make informed decisions and use productive

inputs effectively, resulting in higher yields and the achievement of other farm objectives, in comparison to farmers with lower farm income.

The membership coefficient of the social association, denoted as X_7, exhibited a statistically significant positive effect at a 1% significance level. This suggests that membership in a social association results in a substantial augmentation in the utilization of indigenous knowledge to control land degradation in the region. The discovery suggests that farmers who are affiliated with an association will receive superior and punctual knowledge, credit, and other productive resources to implement more effective and efficient soil erosion management measures compared to their counterparts in the region.

The extension contact coefficient exhibited a statistically significant positive relationship at a 1% significance level. This suggests that as the extent of extension contact increases, there is a notable rise in the perceived effect of soil erosion on maize production in the region. The findings align with the research conducted by Sahya et al. (2021), which emphasized that effective agricultural extension is widely recognized as a crucial factor in promoting innovation and development among farmers. Therefore, the researcher deduces that the socioeconomic features of maize farmers have an influence on their perception of the effects of soil erosion on their maize production.

CONCLUSION

The study determined that soil erosion is widespread in Imo State. The maize farmers observed that soil erosion leads to a decrease in maize yield, the loss of topsoil and nutrients, increased soil compaction, higher input costs such as fertilizers and pesticides, reduced water quality, increased flooding, food insecurity, poverty, decreased agricultural land availability, and a decline in farmers' income.. Maize growers faced many obstacles in implementing control measures, primarily due to insufficient finance, the expensive nature of specific erosion control methods, the absence of government incentives, and the challenges in procuring land for forest formation.

The study makes the following recommendations;

i) Maize farmers should utilize their co-operative association effectively by exchanging pertinent information to mitigate the effect of soil erosion on their agricultural production. Additionally, they can pool their resources in a collective effort to counteract soil erosion.

ii). Therefore, the government should prioritize capacity building for farmers in soil erosion control measures by constructing contemporary drainage systems.

iii) It is recommended that maize farmers be motivated to enhance their educational attainment, as the study revealed a good relationship between education level and the accurate perception of the effect of soil erosion on maize production.

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APPENDICES

Table 1: Distribution based on Socio-economic characteristics of maize farmers in Imo State

Age(years)	Frequency	Percentages (%)	Mean(x̄)
26-35	39	21.67	
36-45	81	45.00	
46-55	48	26.67	
56-65	12	6.67	**42.33Years**
Sex			
Male	71	39.44	
Female	109	60.56	
Marital status			
Single	12	6.67	
Married	153	85.00	
Divorce	3	1.67	
Widowed	12	6.67	
Educational level			
No formal Education	5	2.78	
Primary	49	27.22	
Secondary	92	51.11	
Tertiary	54	30.00	
Household size			
1-4	42	23.33	
5-8	96	53.33	
9-12	36	20.00	
13-16	6	3.33	**7 persons**
Farming size			
0.1 ha - 1.0ha	81	45.00	
1.1ha - 2.0ha	72	40.00	
2.1ha - 3.0ha	27	15.00	**1.25hectare**
Monthly farm income			
21000 – 30000	51	28.33	
31000 – 40000	80	44.44	
41000 – 50000	27	15.00	
51000 – 60000	24	13.33	**₦35,424.74**
Membership co-operative society			
Yes	156	86.67	
No	24	13.33	
Access to credit facilities			
No	108	60.00	
Yes	72	40.00	
Contact with extension service			
Yes	127	70.56	
No	53	29.44	
Years of experience in maize production			
1 - 5	51	28.33	
6 – 10	87	48.33	

11- 15	24	13.33	
16-20	18	10.00	**8.25 years**
Total	180	100	

Source: Field survey data 2023

Table 2: Distribution based on the Causes of soil erosion as Perceived by maize farmers in Imo State

S/N	Perceived causes of soil erosion	S.A	A	D	S.D	Mean	RK
1	Excessive/heavy rainfall and flooding	46	110	10	2	3.10	Ac.
2	Deforestation- destruction of vegetation	4	146	20	10	2.80	Ac.
3	Improper tillage and ridge making	8	122	40	10	2.71	Ac.
4	Unsustainable agricultural practices	30	144	6	0	3.13	Ac.
5	Drought and wind	8	54	114	4	2.36	Rj.
6	Blocked drainage system	44	62	64	10	2.77	Ac.
7	Overgrazing	32	102	34	2	2.96	Rj.
8	Bush burning	2	68	58	52	2.11	Rj.
9	Excessive fertilization or irrigation	28	14	130	8	2.34	Rj.
10	Slope steepness	2	120	46	12	2.62	Ac.
11	Continuous cropping	4	146	20	10	2.80	Ac.

S.A = Strongly Agreed; A = Agree; D = Disagree; S.D = Strongly Disagree; Discriminatory index: $\bar{x} \geq 2.50$ Accepted (Ac.); Rejected (Rj.); Field Survey Data, 2023

Table 3: Distribution of maize farmers based on perceived effects of soil erosion on maize production

S/N	Perceived effects of soil erosion on maize production	SA(4)	A(3)	D(2)	S.D(1)	Mean	RK
1	Decline in maize yield when soil erodes	86	90	4	0	3.46	Ac.
2	Soil erosion leads to food insecurity and poverty	46	130	2	2	3.22	Ac.
3	Increase soil compaction	10	130	34	6	2.80	Ac.
4	Removal of topsoil/nutrient	64	106	10	0	3.30	Ac.
5	Leads to uneven maize growth	24	142	14	0	3.05	Ac.
6	Increases potential input cost	26	74	67	13	2.62	Ac.
7	Reduces water quality, increases flooding	46	118	14	2	3.16	Ac.
8	Reduction in land for agricultural	91	60	24	5	3.32	Ac.

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	activities						
9	Reduction in farmers income	89	65	17	9	3.30	Ac.
10	Use of fertilizer and pesticides	14	26	54	86	1.82	Rj.

SA = Strongly Agreed; A = Agree; D = Disagree; SD = Strongly Disagree; Discriminatory index: $\bar{x} \geq 2.50$ Accepted (Ac.); Rejected (Rj) Field Survey Data, 2023

Table 4: Distribution based on control measure used by maize farmers in coping with the effects of soil erosion on their production

S/N	Soil erosion control measures	*Frequency	Percentage	Rank
1	Contour farming, strip planting	97	53.89	10th
2	Buffer strip	101	56.11	7th
3	Raising ridges to prevent water from running through to the farm	137	76.11	3rd
4	Improve drainage system By channeling rainwater properly	91	50.56	11th
5	Planting of local fence across the land	100	55.56	8th
6	Crop rotation	156	86.67	1st
7	Implementing cover crops, mulching, cover crop	111	61.67	6th
8	Creation of physical barrier to absorb wind and water, Gathering of sands and stones around the land to be cultivated	134	74.44	4th
9	Building and structures should not obstruct water ways	123	68.33	5th
10	Filling the affected area with farm residue	156	86.67	1st
11	Terracing	99	55.00	9th
12	Practicing reforestation, planting of trees and grasses	78	43.33	12th

***Multiple responses were recorded; Source: Field Survey Data, 2023**

Table 5: Constrains to the use of soil erosion control measures on maize production

	Constrains to the use of soil erosion control measures	*Frequency	Percentage	Rank
1	Poor education background	51	28.33	8th
2	Poor information system	101	56.11	5th
3	Poor extension education	87	48.33	7th
4	Inadequate funding	142	78.89	1st
5	Too laborious management	100	55.56	6th
6	Lack of incentive from governments	126	70.00	3rd
7	High cost some erosion measures	132	73.33	2nd
8	Difficulty in acquiring land for forest establishment	124	68.89	4th

***Multiple responses were recorded; Source: Field Survey Data, 2023**

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Table 6: Estimated influence of maize farmers socio-economic characteristic on perceived effects of soil erosion on maize production

Explanatory Variables	Linear	Semi-Log	Double-Log+	Exponential
Constant	12.337	19.588	2.916	3.975
	(5.121)***	(8.710)***	(25.078)***	(21.221)***
Age (X_1)	-0.063	0.045	-0.001	-0.018
	(-0.762)	(3.216)***	(-3.245)***	(-1.751)*
Sex (X_2)	0.181	2.139	0.091	-0.765
	(2.089)**	(0.421)	(0.012)	(-0.279)
Marital Status (X_3)	0.747	-4.703	0.045	-0.082
	(2.396)**	(-0.995)	(5.455)***	(-0.148)
Educational Level (X_4)	0.039	0.076	0.012	0.057
	(0.165)	(2.129)**	(3.943)***	(2.817)***
Households Size (X_5)	0.343	0.084	0.005	0.018
	(2.131)**	(0.052)	(2.137)**	(2.097)**
Monthly Farm Income (X_6)	-8.170E-005	-0.001	2.131E-005	2.941E-005
	(-0.348)	(0.394)	(3.745)***	(2.425)**
Membership Of Social Association (X_7)	0.574	8.201	0.032	0.609
	(0.243)	(1.388)*	(2.159)**	(0.875)
Extension Contact (X_8)	1.436	0.798	0.044	0.627
	(2.821)***	(3.182)***	(3.483)***	(1.214)
Farm Size (X_9)	0.802	0.949	0.123	0.200
	(1.533)	(1.251)	(1.573)	(0.448)
R^2	71.20	59.60	81.70	62.80
F-Ratio	8.829***	10.495***	14.440***	12.534***

Source: Field survey (2023); values in Parenthesis are t-values *Statistically Significant at 10%; **Statistically Significant at 5%; * Statistically Significant at 1%**