



A Survey of Maize Farmers Resilience Strategies on Soil Degradation Problems in Northern Senatorial Zone of Kaduna State

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ABSTRACT

This research was designed to survey maize farmers resilience strategies on soil degradation problems in the northern senatorial zone of Kaduna state, with the following objectives among others; to identify the soil degradation elements affecting maize cultivation and yield, Identify the effects of soil degradation elements in farmers cropping fields, identify farmers coping strategies and resilience soil management practices adopted in reducing the effects of soil degradation in their maize cropping fields. Data collection was done through focus group discussion, oral interviews and the used of structured questionnaires. Data was analyzed using simple percentages, pictorial views and bar- charts. Analysis of results shows that Soil erosion (39%) and Soil nutrients depletion (28%) are the major elements of Soil degradation affecting maize production by the farmers in the study area. Similarly, crops like soya beans, rice and guinea corn constitute major farmers coping strategies as alternatives to maize cultivation as a result of soil degradation problems. Maize Farmers resilience strategies adopted includes; crop rotation, incorporation of organic manures among others in reducing the effects of soil degradation on their maize cropping fields, in order to revitalized maize production in the study area.

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INTRODUCTION

The concept of soil can be explained as a natural body that exists as part of the pedosphere that serve as a medium for plant growth; a means of water storage, supply, and purification; a modifier of the atmosphere; and also serve as a habitat for organisms that take part in decomposition of organic matter and the creation of a habitat for new organism (FAO, 2022). Thus, about 95 percent of our food nutrients come from soils, which have a natural capacity to provide nutrients to support crop growth but not all soils have the same ability to provide these nutrients, because currently we are facing a contrasting scenario of soil nutrients imbalances. In some regions, soils are naturally unfertile with little or no agricultural capability, in other regions, soil degradation has negative effects on soil fertility (FAO, 2022).

In Nigeria, soil degradation is caused by several elements such as soil erosion, nutrients depletion, bad cultural practices, over grazing, deforestation and chemical pollution, which all affect maize production potential and yield. Soil degradation occurs through the deterioration of the physical, chemical and biological properties of soil that results in soil compaction, salinization, acidification, water- log and soil loss from wind and water erosion. (Young et.al, 2015). In another context soil degradation is said to have taken place when the soil within an ecosystem is no longer able to perform its environmental regulatory functions of accepting, storing, and recycling water, air, energy, and nutrients and when its productivity potential becomes non-sustainable (Osman, 2014).

Soil degradation may also be explained as the deterioration of the quality and health of

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soil, leading to a decline in its ability to support plant growth and other ecosystem functions. Land/soil degradation can either be as a result of natural hazards or due to unsuitable land use and inappropriate land management practices (KADA, 2024).

Maize (*Zea mays* L.) is a member of the grass family (Gramineae), originated from South America and introduced to West Africa by the Portuguese in the 10th century (Ogunjimi et al., 2019). Maize has become the second most important staple food in the world and a staple food of great socioeconomic importance in the sub-Saharan Africa (Santpoort, 2020). In Nigeria, it is the one of the most important cereal in terms of area cultivated and volume of production (Aliyu et al., 2022). Kaduna State is the leading producer of Maize in Nigeria with the percentage of 7.4%, based on research conducted by National Agricultural Extension and Research Liaison Services (NAERLS), Federal Ministry of Agriculture and Rural Development (FMARD) and Kaduna state Agricultural Development Agency (KADA) in 2019, (KSPA, 2021).

Empirical studies have reported that the recent reduction in production volume of maize cultivation and other cereals crops in Nigeria and beyond; implied that soil degradation has negative consequence on the production potential of many crops, for instance in 2015, a Research conducted by the Economics of Land Degradation Initiative calculated that soil degradation is costing between \$6.3 and 10.6 trillion dollars per year globally, also a research team from Cranfield University estimated that in England and Wales, soil degradation costs £1.33billion annually. (Young et al, 2015). Thus, recent estimates indicate that every year; Soil degradation affects 12 million hectares (23 hectares a minute) of land, lost to food production and 24 billion tons of fertile soil is irretrievably washed or blown away by soil degradation elements (Aliyu et al., 2020). It is also projected that this will lead to a 12% decline in global food production over the next 25 years, resulting in a 30% increase in world food prices (UNCCD, 2015).

Similarly, Food and Agriculture Organization reported that soil degradation by

erosion is very common in Nigeria and its severity was noted to account for 37.5% of 342, 917 km² as low, 4.3% of 39,440 km² as moderate, 26.3% of 240, 495 km² as high and 27.0% of 255, 167km² as very high. In addition, it was estimated that about 50% of Nigerian land surface is being affected by deforestation, erosion, drought, and salinization leading to desertification, commonly seen in dry land areas of the northern part of the country (Bizi & Sidi, 2023).

STATEMENT OF THE PROBLEM

It is a known fact that maize is the most expensive cereal crop to produce in Northern senatorial zone of Kaduna state owing to the fact it requires much application of chemical fertilizers as a result of low fertility level of our soils due to soil degradation problems (KADA, 2024). The Agency also reported that under good agronomic practices, a maize farmer needs nothing less than 12 bags of synthetic fertilizers at an estimated cost of six hundred thousand (N600,000) to nurse a hectare of maize from sowing to harvesting. This constitute a major reason why many farmers are refusing to embark on maize production enterprise now due to its high fertilizer requirement despite its comparative high price advantage in the market (KADA, 2024). Thus, the degradation of soil quality due to various factors has been identified as a major challenge to maize production and yield in Kaduna state. Hence, identifying the gap created by soil degradation on maize cultivation is very necessary in order to re-strategize with effective farmers coping alternatives and resilience soil management practices on how to improve farmers food security and income on maize production in the Northern senatorial zone of Kaduna state.

Objectives of the Study

1. To identify the soil degradation elements hindering maize cultivation in Northern senatorial of Kaduna state.
2. To physically identify the soil degradation elements diversity on the farmers cropping fields in the study area.

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3. To identify maize farmer's alternative enterprises to maize cultivation due to soil degradation problems in the study Area.
4. To identify maize farmer's resilience soil management practices that will enhance maize cultivation and yield in the study area.

Research Questions

The following research questions were formulated to guide the study:

1. What are the main soil degradation elements affecting maize production potential and yield in Northern Senatorial Zone of Kaduna state?
2. What type of soil degradation elements maize farmers can physically identify in their cropping field within the Northern Senatorial Zone of Kaduna state?
3. What are the maize farmers alternative enterprises to maize cultivation due to soil degradation problems in the study area?
4. What are the maize farmers resilience soil management practices adopted to enhance maize production and yield in the study area?

METHODOLOGY

Study Area

The study was conducted in Northern senatorial zone located in the Northern part of Kaduna state. The zone has a total of eight local government areas out of the twenty three local government areas of the State namely Zaria, Sabon- Gari, Soba, Kudan, Makarfi, Ikara, Kubau and Lere Local Government Areas.. The climate covering the eight Local Government areas is suitable to support optimal conditions for growing maize. The average annual temperature ranges from 36 ° C in the hot months of March through May to 12 ° C in the cold months of July through September. The monthly average rainfall is about 361 mm between May and September, with the wettest month being August (Ghali et al., 2020).

Research Design

According to John W. (2014). A research design is the set of methods and procedures used in collecting and analyzing measures of variables specified in the problem under research. A survey research design will be used for this research work. The reason for adopting survey research design is because the research intends to describe conditions that already exist and to determine how significant they are in this current study.

Sampling Procedure and Sampling Size

The populations of the study are Maize farmers within the eight Local Government Areas constituting the Northern Senatorial Zone of the State. A careful selection of the four LGAs out of a total of eight where there are physical evidence of soil degradation in the farmers cropping field was done in order to justify with proofs the essence of conducting this research work.

A total of 100 questionnaires were administered to the maize farmers in which 25 goes to each of the four local government areas selected for data collection namely Makarfi, Sabon- Gari, Kubau and Lere LGAs. The selection of the four LGAs was based on their comparative advantage in maize production among other Local Government Areas in the Zone.

Instrument of Data Collection

The primary data was collected from the maize farmers through the use of structured questionnaire. In some cases, personal observation and oral interviews were conducted to verify some information in the filled questionnaire. Personal observation with pictures taken were also made in order to support the respondents' responses in respects of soil degradation elements affecting maize production during the process of data collection.

Procedure for Data Analysis

The procedure used in analyzing the data involves the use of simple descriptive statistics such as percentage and bar-chart.

RESULTS AND DISCUSSION OF FINDINGS

The four research questions stated in the introduction to guide the research findings are responded as follows in page title number; 3.1, 3.2, 3.3 and 3.4 respectively.

Soil Degradation Elements Hindering Maize Cultivation in the Study Area

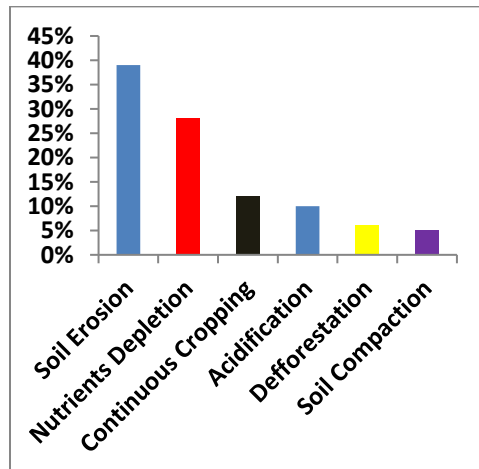


Figure 3. 1.1: Elements of Soil Degradation Hindering Maize Cultivation

The results in figure 3.1.1 above reflected elements of Soil degradation hindering maize cultivation in the study area based on their order of severity as follows; soil erosion is recording the highest with 39%, nutrients depletion 28%, continuous cropping 12%, Acidification 10%, Deforestation 6% and then Soil compaction which recorded the least with 5%. The implication of the results in figure 3.1.1 above shows that soil erosion and nutrients depletion by crop removal as well as bad cultural practices are the major elements of Soil degradation hindering maize cultivation in the study area among others. This is also in line with Ibrahim et al., (2017), on their research "Assessment of Soil Erosion and its Impact on Maize Production in Kaduna State, Nigeria". Revealing that soil erosion and nutrients depletion by crop removal are the major causes of soil degradation in Northern Nigeria.

Physical identification of the Soil Degradation Elements on the Farmer's Cropping Field.

The severity of the soil degradation elements ranking more than others were physically identified by the farmers in their cropping fields during pre and post data collection events in the field as shown in the figure; 3.2.1, 3.2.2, 3.2.3 and 3.2.4 as illustrated below.



Figure 3.2.1: River Bank Erosion at Tsamiyar Masau, Gubuchi Ward in Makarf LGA



Figure 4.3.2: Maize Cropping Field showing Signs Nutrient Depletion in Sabon/Gari LGA



Figure 3.2.3: Maize Crop Field Affected by Water Log in Ramin Kura, Lere LGA

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Farmers Alternative Choice to Maize Cultivation due to Soil Degradation Problems.

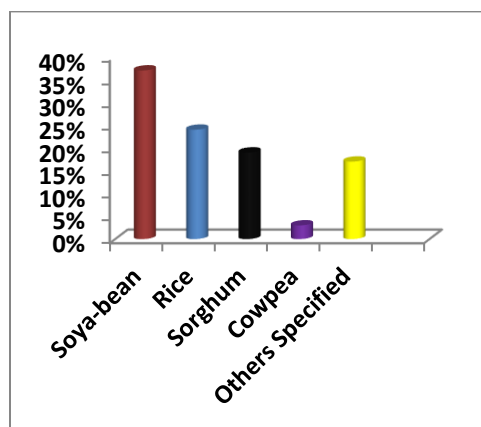


Figure 3.3.1: Alternative Crops to Maize Production

The results in figure 3.3.1 above, shows that, maize farmers in the study area adopted the following crops as alternative to maize production due to soil fertility lost as a result of soil degradation. Soya-beans production recorded the highest alternative to maize production in the study area with a percentage of 37%, follow by Rice with 24% and Sorghum with 19%, and Others specified with a record of 17% among others because of their high adaptability to low soil fertility. This is also in line with Igbadun, H., Olufayo, A., & Suleiman, A. (2018), in their research Assessment on degraded soils with low fertility level can also be good in producing soybeans, rice and sorghum instead of maize production, for maximum yield.

Farmers Resilience Soil Management Practices to Enhance Maize Cultivation and Yield.

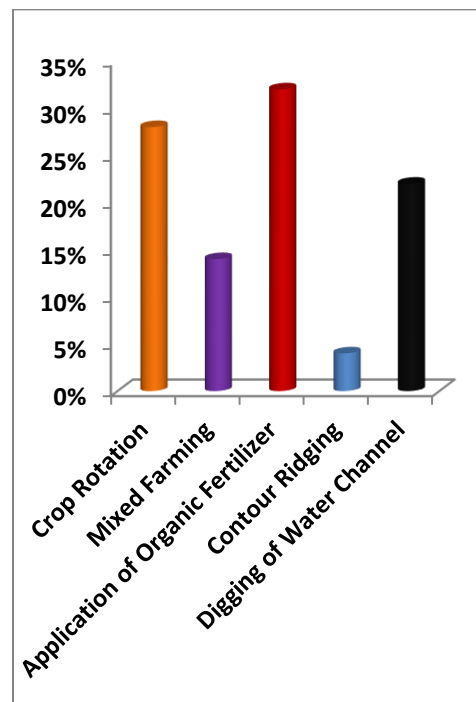


Figure 3.4.1: Management Practices Adopted by Maize Farmers

The results in figure 3.4.1 above, shows farmers resilience soil management practices adopted in reducing the effects of soil degradation in their cropping fields. Application of Organic Manure ranked high with a percentage score of 32%, followed by crop rotation with a percentage score of 28%, digging of water channel with 22%, mixed farming with 14% and contour ridging recording the least with 4%. The above research findings agrees with the findings of Dauda et al., (2016) and Ogundare et al., (2017) that, implementing sustainable soil management practices involves the application of Organic farming practices, such as the use of organic fertilizers and compost, which are all crucial to mitigate soil degradation by nutrients depletion to enhance maize production in Northern Nigeria.

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CONCLUSION AND RECOMMENDATION

The research findings unveil that soil degradation constitute a major factor that hinders maize cultivation in the study area and is also responsible for the high cost of maize in the market because most of the maize farmers have either downsized their scale of maize production or alternatively replaced maize with other crops such as Soyabeans, Sorghum, Rice, cowpea and pepper. In light of the above findings, the research recommends that the extension outfit of the Kaduna State Agricultural Development Agency should wage an aggressive campaign on the significance of farmers resilience soil management practices against soil degradation in order to reduce its impact of soil infertility so as to improve on the status of maize cultivation in the Northern senatorial zone of Kaduna state.

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