

**STRATEGIES FOR CONTROLLING THE EFFECT OF SOIL EROSION  
ON THE PRODUCTIVITY OF MAIZE AND SORGHUM THROUGH  
EXTENSION EDUCATION IN SUDAN SAVANNA ZONE OF NIGERIA.**

Yohanna J. Alhassan

General Studies Department, Federal University Wukari Taraba State, Nigeria.

**ABSTRACT**

The research was carried out on the effects of soil erosion in Fakai Local Government Area of Kebbi State. The data for the research were collected through structured questionnaires. A total of 60 respondents were selected and interviewed in accordance with the study objectives. However, simple percentages and frequency distribution were used to analyze the data. The research examined and identified the extent to which soil erosion problems affected the farmers in the study area, and suggested dependable solutions towards alleviating the problems. The findings revealed that water erosion was the most prevalent agent (rill erosion) that caused much havoc in farming activities. The research also showed that, government/ other agencies assisted farmers in minimizing or alleviating the destructive effects of soil erosion in the area.

**Keywords:** Effects, Soil Erosion, Productivity, Maize and Sorghum

**INTRODUCTION**

According to Anyanwu *et al.*, (1979) the early man was a hunter and a fruit gatherer. His food was made up of fruits he collected from the forest trees around him and the flesh of the wild animals, which he killed during his hunting expeditions. His primary objective was to get his food and as soon as this was done a large area of forest land from which to collect enough food. He had no problems of shortage of food and therefore had no need to think about ways of producing food. However, as time goes on, the number of people continued to increase. It was no longer possible to depend entirely on hunting and fruit collection. Man's experience taught him what to do. He had observed that seeds germinated and grew into plants from graveyard. These produced the same or similar to the original ones. Probably by trial and error he came to know how to plant. It was probably under similar condition that he started keeping some of the young animals that he caught during his expedition.

Akinsami (1975) lamented that, the early men lived by hunting and fishing, and by gathering wild leave, fruits snails and insects. Such primitive methods of feeding left man very much at the mercy of chance. He had no way of making sure that he would find enough food each day. He had to face wild animals and rival tribes competing for the same food. Drought and seasonal changes also affected food supplies. It was not possible to maintain large populations under such conditions. As men progressed from the hunting and gathering stage, they developed the art of cultivating certain plants and domesticating certain animal's people became self-sufficient and began to group themselves in Villages. They made crude implements and learned to provide enough food for the family. They adopted the method of sifting cultivation. The practice can still be found to day in very in very isolated areas where land is still not a limiting factor, and the people have not been exposed to modern farming methods (Gefu, *et tal.*, 2002).

Agriculture is the backbone of a stable economy and its importance, particularly in developing countries of the world cannot be over emphasized. A bulk of human effort (labour) was employed in the progress of human race. In Nigeria, agriculture has traditionally been described as the "Mainstay" of the economy. This because agriculture accounts for so much of the national economy and rough estimate has shown that at least 75% of the population are engaged in farming or other occupation related to Agriculture. Nigeria's dependence on agriculture in pre and post-independence era is unique because it not only provides food but also creates employment opportunities, feeds the industrial sector, provides income and foreign exchange earning which sector, provides income and foreign exchange earning which stood at N190 Million in 1963 (Abdullahi, 999). This accounted for 78% of the total value of export that year. However, with era of oil boom in 1970s, the agricultural sector has suffered avoidable neglect and therefore it's recognition in the nation's economy. Consequently there had been a tremendous exodus from Rural to Urban areas, shifting emphasis from agriculture towards other white color jobs. Despite the role agriculture has played in the Nigerian economy, those engaged in it are often regarded as low class illiterate citizens (Abdullahi, 1999).

However, as intensive cultivation of crops and domestication of animals advanced man was constrained with erosion problems, which is the washing away of the soil by wind, rain or other agents. Soil erosion takes place even under the most stable natural condition like that of virgin forest. The farmer recognized erosion only when considerable amount of soil is washed away and his farming activities seriously affected. Erosion is accelerated when the natural vegetation cover is cleared either for cultivation or by indiscriminate use of the resources. In savanna areas the spare vegetation cover is cleared, thereby exposing the land to soil erosion, the degree of soil erosion is influenced by certain factors which include the amount and intensity of rainfall, the topography of the land, the force of prevailing winds, soil physical characteristics like structure

and texture, the vegetative cover, the crops grown and the system of husbandry adopted (Anyanwu *et al.*, 1979).

The effects of the soil erosion are in many ways more important to man than are those of such geological phenomena as volcanic eruptions and earthquakes. Although they are usually not so striking. This is in breaking down bedrock to form soil. Urban development aggravates some erosion problems, as when housing projects are built on unstable soils that are subject to landslides. In addition, commercial operations such as mining, quarrying and poor agricultural practices take their toll of precious soil. Consequently soil conservation practices are becoming increasingly important as population practices are becoming increasingly important as population grows and land areas are abused on a wider scale (Americana, 1988).

The large share of the soil loss by erosion constitutes the topsoil. It is this topsoil or layer that contains the greater percentage of the essential plant nutrients. The top soil eroded from fields is made up of large fine soil particles of clay, silt, and very fine sand humus (Gefu, *et al.*, 2002)

The importance of soil to plant growth according to Areola, *et al.*, (1978) are enormous, soil is a major element of land which supports many human activities. The soil in any area is at its best when it is still in its natural state under the protective cover of natural vegetation. As soon as man begins to make use of the land and clears the vegetation, the soil is exposed to three kinds of dangers, soil desiccation, soil deterioration and accelerated soil erosion. Soil erosion occurs in most environments, and is part of the natural process by which the earth or land's rock surface is broken down by weathering, flowing water, wind and gravity which carry (transport) grains of soil, often to streams or rivers where they are deposited and in extreme cases into lakes or into the sea. In United Kingdom average soil erosion removes between 5 to 25 tons of soil per hectare per year, which is equivalent to the removal of a depth of soil 0.2 – 1.0mm per year. Since this does not exceed the rate at which new soil is formed, such erosion rates are not normally a problem. Soil erosion becomes an issue to people only when increased rates of erosion interferes with human use of environment. This usually occurs either as a result of extreme weather (for example a severe rainstorm) or as a result of human mismanagement of the soil. (Nicholas, 1999).

Areola, *et al.*, (1978) pointed out that, soil is fundamental to all agricultural practices an great care to be taken to ensure that it is not mismanaged, misused or destroyed. Under natural conditions, soil fertility is replenished through litter fall and organic matter decomposition. But with the interference of man in ploughing up earth and removing the crops that are harvested, this natural balance is upset. Any form of farming is bound to affect the soil in some ways. Apart from the normal erosion of the earth's surface by agents as running water, wind, rain, ice, frost and waves, human ignorance and mismanagement in soil use greatly accelerate this erosion

processes. Ilori, *et al.*, (1984) opined that, the greatest source of loss of soil nutrients however is erosion. Erosion means wearing away of soil particles which takes place when the land surface and natural vegetative cover have been disturbed by man's activities. The process is faster on a barren land or that devoid of vegetation. Rainwater tends to run-off the surface of the soil in deforested or overgrazed areas, thereby removing the topsoil. Deforestation and overgrazing removes the original vegetation which intercept the fall of rain drops and also supplies the topsoil with humus which allows rapid absorption of water (Akinsami, 1975).

Komolafe, *et al.*, (1979) stated that, the top few centimeters of the soil usually contains plant nutrients. The topsoil also is the horizon of active microbial activities, a soil layer containing soil microorganisms and where nitrification and nitrogen fixation takes place. Thus the topsoil can be regarded as a layer of nutrients for most plants. It is however this part of the soil that is destroyed or devastated and transported away by water or wind in a process termed soil erosion.

### **Objectives of the Study**

The broad objective of the study is to identify the effects of soil erosion on the productivity of maize and sorghum in Fakai Local Government area of Kebbi State.

The specific objectives of the study are:

- i. To examine farmers experiences on the effects of soil erosion on the yield of maize and sorghum.
- ii. To identify the role of extension agents in controlling soil erosion in the area
- iii. To identify the major causes of soil erosion
- iv. To determine farmers methods of combating erosion in the area.
- v. To identify major production practices in the area over the years.

### **Statement of the Research Problem**

It has now been recognized that misuse of soil and/or unplanned and improper management of soil constitute the major problems to increased productivity of agricultural crops especially the most staple food crops like sorghum. The success or otherwise the failure of any farming activity depends on erosion free soils and its fertility. In Nigeria both past and present administrations embarked upon different programmes that could check erosion and enhance better productivity of agricultural crops.

### **Justification of the Study**

The research or project work will be very important or significant not only to rural farmers but also to policy makers and/ or government agencies towards evolving agricultural practices that

could stop or minimize erosion and at the same time maintain an increase in the yield of the activated crops. Many people will have instant solutions and measures towards minimizing the devastating consequences of soil erosion which over the years have led to low productivity of agricultural crops especially the most staple food crops like maize (*zea mays*) and sorghum (*sorghum vulgare*). Some rural dwellers who do not easily accept modern farming innovations will benefit from this research as they will be enlightened on the consequences of soil erosion to increased productivity of food crops.

### **Scope and Limitation of the Study**

The study is intended to cover some problems of erosion experienced by crop production farmers in Fakai Local Government area. However, the research work is limited to some selected areas and farms in the study area due to lack of adequate finance, time constraints and inadequate transport. The time of administering the questionnaire which would suit the convenience of both the interviewer and the interviewee is also limited.

### **MATERIALS AND METHODS**

The research was conducted in Fakai Local Government area of Kebbi State, and the State itself was carved out of the former Sokoto State in 1991. It shares common boundaries with Zuru in the South and is at North Eastern part of Danko Local Government. It falls under the Sudan Savanna zone of Nigeria and lies between Longitude 4.3<sup>0</sup>E and Latitude 11<sup>0</sup>N, covering an area of approximately 101 – 200 square kilometers. The area is found at extreme Southwestern part of Kebbi State (Olusanya, 1993 and Olayinka, 2000).

The climate of the study area lies within the tropical Sudan Savanna with a mean temperature between 26<sup>0</sup>C – 28<sup>0</sup>C with rainy season normally between May and October, while dry season last between November and April. The area has favorable climate for cultivation of most crops grown in the Sudan Savanna region of the country. Food crops such as millet, sorghum, maize, rice etc are cultivated in the study area and vegetable crops such as spinach, tomatoes, lettuce, and carrot are grown under irrigated conditions. Animals like sheep goats, cattle and chickens are mostly reared by the inhabitants of the study area. (Olusanya, 1993).

The soil of the study area is moderately deep, well-drained and characteristically sandy loam. The average annual rainfall is about 760mm, the area experiences a period of harmattan between Decembers to February (Olusanya, 1993 and Olayinka 2000).

Inhabitant of the study area have different cultural activities according to the customs, norms and values of their area. The cultural activities of people in Fakai Local Government are seasonal. These cultural activities locally include “Golmo” which is a form of cooperative farming through

which prospective husbands work for their in-laws in payment of bride-price, “DBITI” which is held at the middle of the rainy season to pray for good harvest and also marks the middle of the season, “Uholá” this is carried out at the end of the year and marks the end of the year. It is usually celebrated to thank God for protection throughout the year. The various ethnic groups found in the study area are Dakarkari, Hausa, Fulani, Yoruba, and Igbo and their religions include Islam, Christianity and Magiro (which is a form of lesser god worship) (Olusanya, 1993)

### **Sampling and Sampling Techniques**

A total of 60 farmers were interviewed in three districts of Bajida, Birnin-Tudu and Marafa. With the aid of structured questionnaires using simple random sampling. The questionnaires were administered through personal interview with the farmers. The study area covers both genders (male and female). Both genders were selected because of their involvement in agricultural production in the study area. It covers both literates and illiterate farmers. A total of 60 questionnaires were administered at random.

### **Instruments for Data Collection**

As mentioned earlier, questionnaires scheduled were used to collect data from those farmers that are able to read and write. However, verbal or oral interview was conducted to those farmers that cannot read and write and their responses were recorded in the questionnaires.

### **Method of Data Analysis**

Data collected from the administered questionnaires and verbal interview were collated, tabulated and analyzed using frequency distribution tables and percentages. Percentages were used to test for significant relationships between personal characteristics and their perception on the effects of soil erosion to improved agricultural production in the area. The assessment and/or comparison were carried out on maize and sorghum crops in the study area.

### **Results**

**Table 1: Crop Growth in the Study Area**

Type of crop	Frequency	Percentage
Maize	20	33.3%
Sorghum	24	40%
Millet	9	15%
Rice	5	8.3%
Total	60	100%

**Source: Field Survey 2004**

**Table 2: Farming Practices**

Types of Farming	Frequency	Percentage
Mono cropping	28	46.6%
Mixed cropping	17	28.3%
Mixed farming	15	25%
Total	60	100%

**Source: Filed Survey 2004**

**Table 3: Causes of Erosion**

Agent	Frequency	Percentage %
Overgrazing	15	25%
Excessive down pour	20	33.3%
Deforestation	14	21.6%
Flood	12	20%
Total	60	100%

**Source: Filed Survey 2004**

**Table 4: Nature of Erosion Problems**

Nature of Problem	Frequency	Percentage %
Exposing plant roots	29	48.3%
Removing the whole crops	21	35%
Burning the crops	10	16.6%
Total	60	100%

**Source: Filed Survey 2004**

**Table 5: Methods of Erosion Control.**

Methods	Frequency	Percentage %
Contouring	16	26.6%
Terracing	22	36.6%
Strip cropping	11	18.3%
Cover cropping	11	18.3%
Total	60	100%

**Source: field Survey 2004**

**Table 6: Effects of Erosion on Maize and Sorghum**

Response	Frequency	Percentage %
Severe	28	46.6%
Less severe	26	43.3%
No effects	6	10%
Total	60	100%

**Source: Filed Survey 2004**

**Table 7: Yield of Crops Obtained Annually from the Affected Land**

Yield	Frequency	Percentage %
High yield	11	18.3%
Moderate	17	28.3%
Low yield	32	53.3%
Total	60	100%

**Source: Field Survey 2004**

## **DISCUSSION**

Results of the research revealed that different types of crops are grown in the study area, 33.3% of the farmer's engaged in the cultivation of maize, 40% of the farmers engaged in the production of sorghum, 15% cultivates millet and the remaining 8.3% deals with the cultivation of rice this data is obtainable in table 1.. From the above therefore, it can be seen that, majority of the farmer's cultivate sorghum and maize in large scale, this is because there is enough precipitation throughout the year, the soil also is fertile enough to support optimum productivity and farmers mostly preferred maize and sorghum, while millet and rice are cultivated in smaller quantities.

Findings in table 2 indicated the type of farming practiced by the farmers in the study area. 46.6% of the farmers practiced mono-cropping, 28.3% practiced mixed cropping and 25% of the farmers practiced mixed farming. It can therefore be seen that greater number of the farmer's in the study area practiced mono-cropping involving either only maize or sorghum on a very vast area of land and when excessive precipitation is received in the area, the crops are easily water logged which causes logging of the crops as such that had over the years led to low output of the crops and sometimes complete losses are recorded. Study in Table 3 showed the most important factors that cause's water and wind erosion in the study area. 25% of the respondents mentioned overgrazing as the most prevalent agent of erosion, 33.3% viewed excessive downpour as the most serious agent of erosion, and 21.6% said that, it is deforestation while the remaining 20% pointed out flood as the main agent. It could be seen from the result of this research that, the most serious and devastating agent of erosion is excessive downpour (precipitation) and the

experience in the area shows a lot of destructions to sorghum by either removing the whole crops or exposing the plant roots as a result of which the output becomes grossly affected.

The outcome of the research as evidenced in Table 4 revealed that 48.3% of the respondents in the study area were adversely affected with the problem of erosion through the exposure of the plant roots, 35% support that, the nature of the problem is by eroding the whole crops, and the remaining 16.6% said that, the nature of the problem is that of buying the crops. Thus, the most grievous nature of erosion in the study area is the exposure of the plant roots which limits the nutrients absorptive capacity/ability of the plants and therefore the yield of the crops. The exposed roots become vulnerable to damages by insects such as crickets and locusts. This can further aggravate the problems of maize and sorghum production in the study area Results in table 5 indicated ways of combating erosion in which 26.6% of the respondents attempted to combat erosion by contouring, 36.6% adopted terracing as their method of control, 18.3% attempted to combat erosion by way of strip cropping and the remaining 18.3% of the respondents combat erosion by cover crops. Therefore, the most prevalent method of combating erosion by the farmer's in the study area is terracing, this could be because the area is undulating and the method is simpler as it entails arranging of stones and other obstacles across the direction of the slope/water. Table 6 indicated that, 46.6% of the respondents perceived the effects of erosion as highly severe, while 43.3% viewed it as been less severe, and the remaining 10% look at it as having no effects on the production of crops especially maize and sorghum. It can therefore be lamented that 46.6% of the respondents were severely confronted with the problem of erosion in the production of maize and sorghum and that had also over the years affected the productivity of agricultural crops at large.

Highlights the yields obtained from the erosion affected areas were shown in table 7 whereby 18.3% of the respondents obtained high yield of crops despite the problems of erosion, 28.3% of the respondents lamented that moderate yield was obtained from the affected lands and the remaining 53.3% opined that low yield of crops is obtained annually from the affected lands, this has tallied with the findings of Fitzpatrick (1986) who stated that, valuable fertilizer's applied on the farms to boost agricultural crop production were washed away by running water as such the yield of crops is drastically affected and/or influenced.

## **CONCLUSION**

The study was conducted in Fakai Local Government area of Kebbi State to identify or examine the effects of soil erosion as bottlenecks or constraints towards production of maize and sorghum. A total of 60 questionnaires were administered in the study area to obtain classified information from the respondents (male and female). The study reveals that, majority of the farmers in the area were male and were married while female formed the minority in farming

activities. This was attributed to the fact that, most of the female in the study were totally dependent on their husbands and other reasons for low physical participation could be attributed to cultural beliefs and weaknesses. Most of the farmers in the study area were engaged in the production of cereal crops such as maize, sorghum, rice and millet, and water was discovered to be the major agent of soil erosion in the area and that rill erosion was most prevalent. Farmers state of education was very poor, greater number of the farmers do not receive western education and that had contributed to the low production of most of the agricultural crops in the area particularly maize and sorghum.

Most of the farmers in the study area testified that, erosion affected their crop production activities and the effects manifestation was in terms of increase in the cost of production. The result of this research also showed that, majority of the farmers were severely confronted with the problems of erosion. Furthermore, there were tremendous efforts by the farmers in combating erosion though was unskillful and very unscientific in nature .It was observed that soil erosion affected the level or rate at which farmers produce crops and that most of the inhabitants of the study area engaged largely in the production of cereal crops. Excessive downpour formed the most prevalent agent of erosion in the area and had over the years led to decreased productivity of most of the staple food crops grown in the area particularly maize and sorghum. Progressively, despite the efforts of farmers in combating erosion over the years, it still posed a threat to the production of crops. More so inadequate collateral security rigidity of government credit scheme and sole dependence on the personal serving by the farmers in the study area hindered their efficiency in the production of maize and sorghum.

## **RECOMMENDATIONS**

Considering the huge success recorded in this research, the following recommendations were made to improve the situation.

- Afforestation of the entire barren lands with trees to provide canopies that could reduce or prevent direct impact of rain drops to the soil thereby halting erosion problems.
- Financial assistance to the farmers through agencies such as People's Banks, Community Banks and the Nigerian Agricultural Co-operative and Rural Development Banks (N.A.C.R.D.B) in particular should be provided.
- Construction of contour banks and/or terraces should be embarked upon by the farmers that could reduce or totally eliminate the problems associated with erosion.
- Extension network should be provided to reach all the farmers in the study area and to provide services on the methods/techniques of arresting erosion problems to increase productivity of maize and sorghum.

- Co-operation is the bedrock of development. Therefore it is recommended that farmers should form co-operative societies that will enable them secure loans from the banks in their bid to control erosion menace.
- The government should construct drainages in the area to assist in checking erosion problems.
- The government should assist the farmers by providing seedlings for slope planting e.g. grasses that would reduce or prevent fast run off and therefore erosion.

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