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Assessment of Erosion Control Measures A Case Study of Birnin Kebbi, Nigeria

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ABSTRACT

The research was carried out to assess the erosion control measures in Birnin Kebbi. The Research was conducted in an area affected by flow of water causing erosion leading to gully type. Widths of the eroded area were used as basis for observation for the research. The depth of the eroded area varies considerably from upstream to downstream. Downstream is shallow which is due to deposit of materials while upstream is as deep as 2m or more in some areas. Gabion, dyke and five (5) species of grasses that include Bahama Grass Cynodon dactylon, Sicklepod Cassia obtusifolia, Leptadenia specie Leptadenia lancifolia ,Castor plant Ricinus communis and lovegrass Eragrostis tremula were used as erosion control measures for the research. The control measures were assessed for three consecutive years from 2013 to 2016 and the results of the research shows an average width increment of 1.08m for dyke and 0.92m for gabion while the area treated with vegetation has width increment of 0.62m and 0.55m for grass combination of three and five respectively. The result shows that area treated with grasses as control measures has less increment compared with the remaining areas where dykes and gabion were used as control measures. The Year 2016 has maximum effect for all the measures used for control as a result of high rain fall for the year.

Keywords: Gully Erosion, width increment and control measures

I. INTRODUCTION

Erosion is the gradual removal by rain or wind of the top soil in which crops grow. Erosion occurs in all parts of the world. If left uncontrolled, it can bring about the ruin of a nation's economy, (Toy, *et al.,* 2002). In the tropics, as long as the land remains covered with natural vegetation, the danger of erosion is minimal. But as soon as the forest is cut down for agricultural purpose erosion can begin. In deserts, erosion is almost a continuous process because owing to the lack of vegetation the soil never has time to settle down and to be bound together by rotten organic matters, *(*Whisenan, 2008*).* Desertification appears to be one of the major environmental problems in Kebbi State manifesting itself through incidences of wind erosion, accumulation of dune and exposure of lateritic ironstone on the landscape. This is as results of number of factors, both natural and man-made. The factors are; excessive sourcing for fuel wood, limited rainfall, grazing techniques, indigenous methods of cultivation. Environment is deprived of its natural vegetation due to combination of all the factors mentioned above, thus creating incidence of fast soil erosion in addition to the recurrent drought nature of low average annual rainfall and uneven distribution, (Agwu and Okhimamhe, 2009). Several measures of erosion control including the use of gabions, bench terraces, contour bunds and vegetation are being practiced to control erosion. Although these measures have shown effective results in some parts of the country, they have been without success in many other parts of the country. The major reason is either

that they are laborious and time consuming to construct or that they do not fit the farming systems of the area, or they need more technical inputs, (Owino, 2004).

Major variables affecting soil erosion are climate, soil, vegetation and topography. It is unfortunate that the soil and water conservation branch of the ministry of Agriculture, which is the main government division that coordinates soil conservation work throughout the country, has had very little interest in erosion control system. As a result, most of the agricultural extension staff and farmers have little or no knowledge at all of the benefits of erosion control, (Cerdan, et al, 2012).

The aim of this work is to assess erosion control measures that include dyke, gabion and the used of vegetation in the eroded area, in order to come up with the best measure for the area.

II. MATERIALS AND METHOD

Description of the Research Area

The research was carried out in Birnin Kebbi which lies at latitude 12^0 32'N and longitude 4^0 12'E and an altitude of 200m above the sea level in the Sudan Savannah vegetation zone in northern Nigeria. The soil in the area is very susceptible to erosion due to their coarse textures, poor soil structure as a result of low organic matter and clay contents, tendency to form crust and surface seals and poor inherent fertility (Bashir, 2009).

The area has a semi arid climate that is characterized by a long dry (October-May) and a short wet June-September season, with a mean annual rainfall of 665mm. The temperature ranges between 22 °C to 45^0C (Adekunle, 2004).

Method

A reconnaissance survey was carried in the area. This was to enable the researcher know true situation of erosion on ground, Channel created by the flow of water was divided into A, B, C, D, and E, sections towards the end part of channel at downstream where it is expected that the velocity of flow is maximum. Section A, used as control was left untreated naturally as it is while a dyke was constructed at section B. Gabion was used at section C as means of control and section D is the area where combination of five types of grasses that include Bahama Grass *Cynodon dactylon,* Sicklepod *Cassia obtusifolia,* Leptadenia specie *Leptadenia lancifolia* ,Castor plant *Ricinus communis* and lovegrass *Eragrostis tremula* were used as control measures. Section E was treated with three different species of grasses that include Sicklepod *Cassia obtusifolia,* Castor plant *Ricinus communis* and lovegrass *Eragrostis tremula.*

Plate 1. Sicklepod *Cassia obtusifolia,*

Plate 2. Leptadenia specie *Leptadenia lancifolia*

Plate 3. Castor plant *Ricinus communis*

Plate 4. Bahama Grass *Cynodon dactylon,*

Plate 5. lovegrass *Eragrostis tremula*

Plate 6. A Eroded Width in The Research Area of Section A

Plate 7. Area where Dyke was Used

Plate 8. Area where Gabion was used

Plate 9. Use of Combination of Five Grasses

Plate 10. Use of Combination of Three Grasses

Plate 11. Upstream Area Developed Gully Erosion

Data Collection

The widths of each section were taken at the end of the raining seasons for period under study. Measurement were made using measuring tape and at the end of every year a bench mark was set up which was used for the following year.

III. RESULTS AND DISCUSSION

Results

The results of the measurements are tabulated in Table 1 below

Table 1. Annual Increment in Width of Erosion Affected Area

Year Measured	2013 BM	2014	2015	2016	Avenge (m)	Total eroded width (m)
(A) Control	2.50	1.10	1.30	1.75	1.38	4.15
(B) Dyke	3.7	0.80	0.95	1.5	1.08	3.25
(C) Gabion	2.8	0.62	0.91	1.25	0.92	2.78
(D) Vegetation (5 combo)	2.2	0.40	0 .50	0.75	0.55	1.65
(E) Vegetation (3 combo)	2.5	0.55	0.60	0.70	0.62	1.85

Discussion of Results

The Results obtained in the research shows that area treated with Dyke has an average width increment of 1.08m while the area where gabion was used show an average width increment of 0.92m and the area treated with vegetation has less width increment of 0.55m and 0.62m for combinations of 5 and 3 different grasses respectively over the period of the study. The result of the research indicated that vegetation is more effective measure of erosion control as it has less width increment for two combinations compare with other measures adopted for the control. The result of the study also shows that gabion is more effective erosion measure than dyke as it has a less width increment when compare to dyke for the period of study.

IV. CONCLUSION

The Research assessed and compared three erosion control measures that include: Dyke, Gabion and Vegetation for three consecutive years and the findings of the Research shows that vegetation (grass combination) to be more effective erosion control measures than the other measures adopted for the Research.

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