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EROSION CONTROL MECHANISM USING VETIVER GRASS IN UZUAKOLI, SOUTH EAST NIGERIA

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Abstract

Erosion has been one of the major challenges facing the southern part of Nigeria. The amount of rainfall, soil and topography of this region is one of the factors influencing the rampant occurrence of erosion. This study was therefore aimed at assessing the erosion control mechanism using Vetiver grass in Uzuakoli community, Bende L.G.A., Abia State between June – August, 2020. Purposive sampling technique was used in selecting five (5) erosion prone areas within the community. The result indicates that Row 3 (92.7cm) had the highest depth of terrace formed within the research period, followed by Row 2 with 87.8cm and Row 1 being the least at 82.1cm. Further observation revealed that the means by the rows covering the periods June, July and August grouped by one factor are significantly different based on F-cal.>F-crit. 27.08704 > 4.256495. It clearly indicates that there is a significant difference between the Row 1, Row 2 and Row 3 at p-value > 0.05. Furthermore, there is a significant difference between the interaction of rows in each month at p-value > 0.05 during the season Over time, it was observed that the roots of the tillers penetrate deeply into the soil and intertwine with each other thereby creating a compacted system that strengthens the soil which reduces the rate of soil displacement during rainfall. The study therefore recommended farmers within the community to adopt the use of Vetiver system to checkmate future erosion crisis in the area for sustainable environmental soil quality.

Introduction

Erosion is caused by drag or tractive forces which are the function of velocity, discharge, shape of particles and roughness of particles. On the other hand, erosion is resisted by inertial, friction and cohesive forces which are the function of basic soil properties, soil structure and Physicochemical interactions. Prevention and control of erosion depends on understanding of the Mechanics of the erosion process. Erosion is basically a two-fold process that involves: particle detachment and particle transportation. Erosion protection essentially consists of decreasing drag or tractive forces by decreasing the velocity of water flowing over the surface or by dissipating the energy of the water in a defended area, and increasing resistance to erosion by protecting/reinforcing the surface with a

suitable cover or by increasing inter-particle bond strength. The use of Vetiver is known to protect the soil surface from raindrop impact, thus, in turn, preventing seal formation, infiltration reduction, and soil detachment (Truong et al., 2003)

In Uzuakoli Community of Abia State, five prominent erosion sites have threatened the livelihood and well-being of the people. They include Erosion site at Eke Ukwu - Methodist Church, Ngwu Railway, Oba Amewu, Oba Eluoma and Aro Quarters Amuda line. Unfortunately, the erosion sediment emptied itself into downstream thereby affecting surface water bodies like Ilo stream, Nvuvo Amankwo, Iyi Nzu, Gere gere (spring), Oso Gworo Gworo, and Arua Eluoma stream. Forced by the situation, the community has resulted to use of borehole water instead of relying on these natural sources of drinking water. Several efforts have been made by world Bank intervention programs such NEWMAP to control the menace of erosion in the area. Although much results have been recorded, yet more effort is needed to rescue the community from total collapse. The community based participatory approach is useful for the success of integrated watershed management, which requires involvement and contribution of local people.

Study Area: The study was carried out in Uzuakoli community in Bende Local Government Area, Abia State, Nigeria. The area has a population of about 128,227 based on population census 2006, with a land area of 601km2. Uzuakoli is located at latitude 5038'0" and longitude 7034'0".

Sampling methods

A purposive sampling method was employed in selecting five areas prone to erosion within the community which includes; erosion site at Eke Ukwu - Methodist Church, Ngwu Railway, Oba Amewu, Oba Ehioma and Aro Quarters Amuda line. Tillers of Vetiver grass were purchased from a reliable local farm in Ikwo Ebony State and were planted in three (3) rows perpendicular to the slope or eroded area. The depth of terraces formed through sedimentation were measured and recorded for three months.

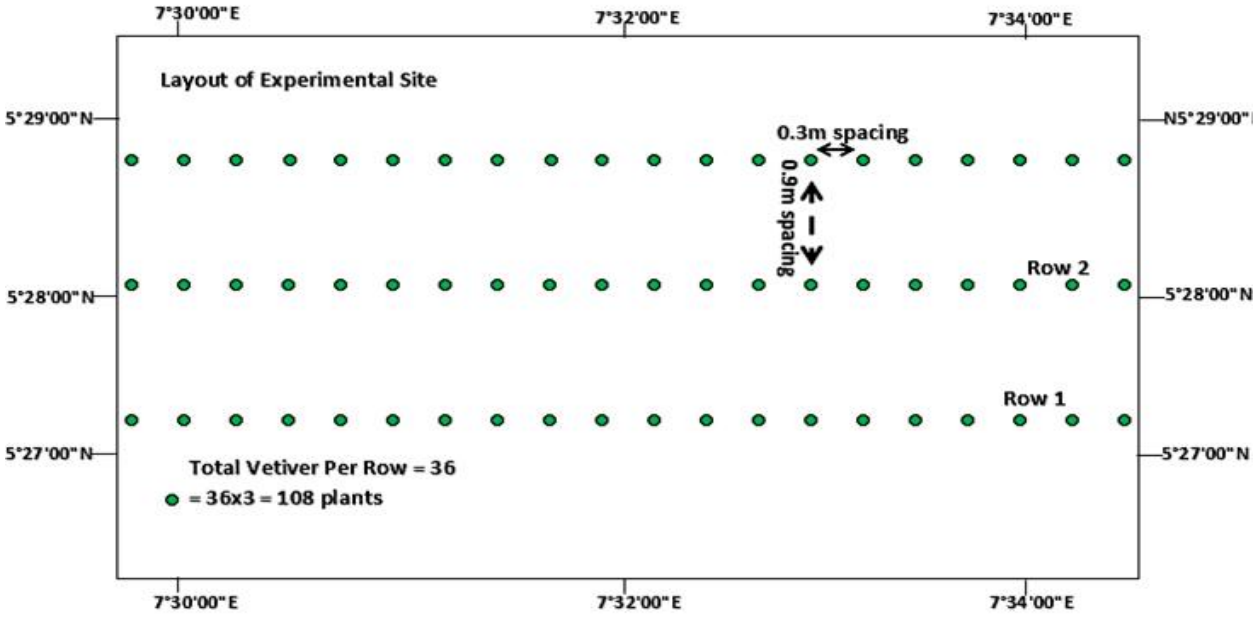

Fig.1 Experimental Layout of the study area

Results and Findings

Soil Reinforcement by Vetiver Roots in the Area

Table 1.0 shows results of soil reinforcement in the areas covering the months June – August, 2019 at which the research was carried out.

Table 1.0: Soil Reinforcement by Vetiver Roots

Soil Reinforcement (Depth of Terraces (cm))			
Months	**Row 1**	**Row 2**	**Row 3**
June	10.0	9.5	8.0
	11.5	13.0	12.0
July	12.0	13.0	17.0
	14.0	16.0	17.5
August	16.0	17.3	18.2
	18.6	19.0	20.0
Total	**82.1cm**	**87.8cm**	**92.7cm**

The data shown in table 1.0 indicates the depth of roots of Vetiver and sum total of depths within each row (Row; 1, 2, 3) during the period of the research (June, July and August, 2019). The tables show the variation within rows and it was observed that during the research period Row 3 had the highest value of soil reinforcement by depth of terrace formed, followed by Row 2 and the least being Row 1. This was as a result of soil movement and root intertwining network within the rows of Vetiver grass, which enabled the roots to trap soils within each row.

Table 2.0 ANOVA for soil reinforcement by vetiver roots (Depth of Terraces)

Soil Reinforcement (Depth of Terraces (cm)

SUMMARY	**Row 1**	**Row 2**	**Row 3**	**Total**
June 2020				
Count	2	2	2	6
Sum	21.5	22.5	20	64
Average	10.75	11.25	10	10.66667
Variance	1.125	6.125	8	3.366667
July 2020				
Count	2	2	2	6
Sum	26	29	34.5	89.5
Average	13	14.5	17.25	14.91667
Variance	2	4.5	0.125	5.041667
August 2020				
Count	2	2	2	6
Sum	34.6	36.3	38.2	109.1
Average	17.3	18.15	19.1	18.18333
Variance	3.38	1.445	1.62	1.937667
Total				

Count	6	6	6
Sum	82.1	87.8	92.7
Average	13.68333	14.63333	15.45
Variance	10.16167	11.94667	20.455

The root depth and soil reinforcement summary and ANOVA in Table 2.0 indicate the difference between root depth and terraces formed in each row. It revealed that the means of the observation by the rows covering the periods June, July and August) grouped by one factor are significantly different based on the F-cal.>F-crit. (27.08704 > 4.256495). It clearly indicates that the means of the observation by columns are not similar i.e. there is a significant difference between the Row 1, Row 2 and Row 3 at p-value > 0.05.Futhermore,there is a significant difference between the interaction of rows in each months at (p-value > 0.05).The ecological implication is that over time the roots of the plant penetrates deeply into the soil and intertwine with each other thereby creating a compacted system that strengthens the soil thus further reducing the rate of soil displacement during rainfall.

Findings

From the research, it was observed that Vetiver is an effective method of erosion control which if properly done will control erosion and also reinforce the affected wall. Although this is dependent on the time frame on which the method would be used. It was observed from other research studies that roots and rhizomes of the vegetation interact with the soil to produce a composite material in which the roots material are fibres of relatively high tensile strength and adhesion embedded in the matrix of lower tensile strength. The shear strength of the soil is therefore enhanced by the root matrix. Since shear strength affects the resistance of the soil to detachment by rain drop impact (Cruse and Larson, 1977; Al-durrah and Bradford**,** 1982), and the susceptibility of the soil to rill erosion (Laflen, 1987 and Rauws and Grovers, 1988) as well as the likelihood of mass failure, root systems can have a considerable influence on all these processes. The maximum effect on resistance to soil failure occurs when the tensile strength of the roots is fully mobilized and that, under strain, the behavior of the roots and the soil are compatible. This requires roots of high stiffness or tensile modulus to mobilize sufficient strength and the 8-10% failure strains of most soils. Root failure occurs when their tensile strength exceeded.

Conclusion

It can be concluded from the study that root depth, network and other characteristics such as shear strength and tensile strength improves slope stabilization. Erosion can be controlled through the process of terracing formed by the silts trapped within the roots and tillers of the Vetiver. All these factors including the ability of Vetiver in the control of erosion and slope stability is greatly dependent on time variable (i.e., durations of establishment of the Vetiver roots). Moreover, individual efforts such as use of Vetiver grass should be encouraged especially by individual farmers as a means to check future erosion crisis in the area for sustainable environmental soil quality.

Plate 1 above: shows vetiver grasses planted in rows to check erosion

Plate 2 above: shows a house at Eke- Ukwu being protected from erosion using Vetiver grasses

Plate 3 above: Local cassava mill affected by erosion near Eke-Ukwu Methodist Church.

Below: shows an eroded residential apartment. Urgent steps needed to secure the area

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