VETIVER GRASS; AN EFFECTIVE TOOL FOR SOIL AND WATER CONSERVATION – A Review

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Abstract

The campaign and promotion of vetiver system technology has been in the media space for several years. The need to ascertain the output of this initiatives is as important as the idea itself. Hence, this work reviewed research studies on the effectiveness of vetiver system application in the area of soil and water conservation for the last decade. Most of the reviewed studies identified vetiver grass as a cost effective, ecological friendly and sustainable approach to soil and water conservation while identifying challenges in most areas where vetiver system technology is being applied to include; poor documentation of performance results, lack of proper design framework for its effective application and limited knowledge of the technology in most remote areas of the tropical regions of the world.

Introduction

Soil and water degradation is a serious issue of global concern, since erosion of arable land resulting in global food shortage and the presence of unprotected land are evident in most parts of the world. Junge *et al*. (2008) noted that the agrarian stagnation, plaguing food security in sub-Saharan Africa since the early 1970s, may exacerbate with the projected climate change along with the increase in risks of soil and environmental degradation.

For the past decade, concerted efforts have been made to address the menace of soil and water degradation and disasters by adopting various soil and water conservation options. Joseph *et al.* (2017) was of the opinion that the correlation between ecosystem and disasters are widely documented but are inadequately integrated into disaster risk reduction initiatives and developmental programmes. They also noted that ecosystem based regional developmental programmes are emerging worldwide and hence green technologies and systems for the prevention and mitigation of natural hazards need to be developed.

While the use of civil structures have gained dominance over the years as soil and water conservation tool, the catastrophic impact of a poorly designed and failure of such structures for

the last decade has triggered revolution and substitution of such practices. Most recent soil and water conservation engineering is embracing green technologies which proved to be more sustainable and eco-friendly solution at a time when the world is threaten by climate change.

The most dominate green technology in use for soil and water conservation as reported in most literatures is Vetiver System Technology (VST); the science of vetiver system applications.
Vetiver grass plantation in erosion prone, earthquake and hurricane areas could be a promising viable option to control soil erosion and its detrimental effects (Gnansounou *et al.,* 2017). Going by this assertion, there is need to review some literatures of the last decade to validate the uniqueness of Vetiver grass as an effective tool for soil and water conservation.

Vetiver Grass for Soil and Water Conservation for the Last Decade

Gnansounou *et al.* (2017) observed in a research study related to vetiver applications, policy recommendation, limitations and potential large-scale applications that vetiver plantation for soil conservation has become familiar among Haiti famers were in recent times, 900 farmers have taken part in a Vetiver plantation and management program Agri-plus conducted by a volunteer organization which has shown remarkable output in reducing soil loss from their arable lands.

Jiru and Wari (2019) in their study in Ethiopia, reported that due to the exceptional characteristics of vetiver grass, it plays great roles in reducing soil erosion and runoff, improvement of soil fertility, soil moisture conservation and terrace formation. These unique characteristics of vetiver grass identified as its predisposing factor to successful performance includes very strong fibrous root system which goes depth into the soil and forms a tightly knitted network that binds underground soil together and retards water flow while assisting water to seep into the soil. Furthermore, they observed that even though vetiver grass has been restoring degraded land for more than fourth decades in Ethiopia, there are no enough documents testifying its effectiveness in its other areas of application.

The success of vetiver system application in the state of Kerala in India and the implementation strategy for the vetiver system in the fields with the collaboration of Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) is a testimonial to the effectiveness of VST in

the area of soil and water conservation (Joseph et al., 2017). Similarly, they identified Vetiver system as very cost effective and efficient Ecological disaster risk reduction technology that can address both long term and short term risk with ecosystem management. In furtherance of the study, they established an opinion that successful application of the VS can reduce or even eliminate many types of natural hazards such as landslides, mud slides, road bund instability, and erosion.

Wolde (2015) stated that there is concrete evidence that properly established Vetiver hedgerows will reduce soil loss to acceptable levels (< 3 tons/ha) and runoff by as much as 70% depending on slope and soil type. This being the objective of most soil and water conservation measures, was identified to have positive effect on soil moisture content culminating to improved crop yields, particularly on shallow soils. This by implication means that there is a clear correlation between Vetiver hedgerows and improved groundwater recharge which validates the view of Grimshaw and Helfer (1995) that farmers see Vetiver hedgerows as improving runoff infiltration, and reducing runoff velocity.

Okafor (2019) studied embankment stabilization using vetiver grass (*Chrysopogon zizanioides*) in Umuda-Isingwu community south - eastern Nigeria with the predominated soil types as coarse sand and loamy sand. The result obtained from the study revealed that average shear strength of the control (bare) soil samples and Vetiver rooted soil samples were 68.52KN/m^2 and 132.32KN/m^2 respectively. In expressing the stability of this same embankment, the factor of safety of the samples; bare and Vetiver rooted soils were computed to be 1.72 and 2.98 respectively. These observations showed that vetiver rooted samples are 1.73 times more stable than the bare soils. Hence, the stability contributions of vetiver grass to the embankment under study qualifies it as effective conservation tool in the area slope management and stabilization in Nigeria. Irrespective of this epic revelation, the VST is currently poorly implemented in the area.

Truong (2011) while reviewing the performance of Vetiver System Technology (VST) during "**Summer of Disaster**" (December 2010- March 2011) which resulted to flooded area equivalent to France and Germany combined when scale in perspective by December 2010 and a massive cyclone of category 5+ monster by March 2011 stated that with good design and proper implementation, VST is the most effective, low cost and environmentally friendly solution for erosion and land slide prevention and rehabilitation.

Using the cohesion and angle of internal friction obtained in the study by Nasrin (2013), the stability of embankment slopes were estimated using 'infinite slope method of slope stability analyses. From the analysis, it was found that vetiver grass plantation is able to increase the factor of safety of embankment slope by 1.50 times while from the erosion test, vetiver grass the result showed that reduces the erosion by 71%. This validates vetiver grass plantation as a good protector of embankments from rain-cut erosion and shallow depth slope failure.

The status of vetiver grass as a technique for soil and water conservation in Lay Armachiho woreda was study in Teshome (2016), where it revealed that soil erosion is one of the most severe problems affecting the agriculture sector in Ethopia. In a bid to control and mitigate this environmental challenge, an NGO adopted vetiver grass as a biological control measure. Evaluation of the performance of the biological measure adopted shows that education, use of physical and biological SWC structures, effectiveness of vetiver grass for SWC, training and technical support by environmental agents and agricultural experts were found to be significantly related to the adoption of vetiver grass as biological soil and water conservation. Hence, the systematic use of vetiver grass for multiple application give a valuable and beneficial strategy for soil management and preservation of natural environment.

Tesfaye et al (2018) studied implementation and effect of vetiver grass on soil erosion in Somodo watershed, south –western Ethopia. They opined that the implementation of physical and biological soil and water conservation practices in Somodo model watershed involving bund construction and vetiver grass plantation is drastically essential to increasing the soil fertility, production and productivity, reduction of the slope of the area and reduction of severe erosion in the watershed.

CONCLUSION

From this review, it is obvious that vetiver system technology has been embraced and adopted as an effective soil and water conservation in most recent times having demonstrated resilience in most tropical parts of the world. This status of VST as becoming the most favourite soil and water conservation measure can be trace back to the global campaign and education directed towards providing ecological friendly solutions to greenhouse gases emission challenges culminating to

climate change and exponential rise of atmospheric temperature in most tropical regions. In a bid to make VST a household SWC tool, more awareness through trainings, mass education campaigns should be directed to remote regions with little or no knowledge about this green technology which happens to be cost effective, environmental sustainable and simple SWC measure.

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