

Variability in the Physical Properties of an Eroded Cultivated Steep Land Under Farmers' Practice and Vetiver Technology (Bio-Engineering Structure)

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Abstract

Variability in soil properties is evident in the variability in crop performance in a field and failure of engineering structures. During erosion particles are detached, transported and deposited at different locations down the slope. An experiment was conducted on a 20 and 30% slopes within the Cross River University of Technology to assess variability in soil physical properties as induced by water erosion on erosion plots constructed and planted to maize/cassava mixture. No vetiver [farmer's practice] and vetiver grass strips at 5m, 15m and 25m [bioengineering structure] constituted the treatments. Core samples (0 - 15cm) were collected at 5m intervals down the slope in all the treatments for determination of some soil physical properties. Infiltration was measured using double ring infiltrometer. Coefficient of variability (CV%) values ranged from 2 - 4% [bulk density], 2 - 4% [porosity], 16 - 33% [gravimetric moisture], 3 - 8% [void ratio], 16 - 33% [volume wetness], 15 - 32% [degree of saturation], 16 - 37% [water volume ratio], 2 - 7% [air-filled porosity], 16 - 33% [available moisture holding capacity] for the two slopes. Initial infiltration ranged between 1.87 - 2.90cm per minute and 82.63 - 127.80cm after 260 minutes for cumulative infiltration. Coefficient of variability were 19.5% [initial infiltration] 6.18% [cumulative infiltration] for 20 and 30% slopes respectively. CV% values of <15%, 15 - 35% and >35% are considered low, moderate and high respectively. Understanding field variability of soil properties could be a veritable tool for precision soil management to optimize and increase profitability.

Keywords: Erosion, Vetiver, Bioengineering structure and Soil Variability

1.0 INTRODUCTION

Soil erosion brings nearly irreversible changes in the physics of the soil (Oku, 2002). The disappearance of the soil leads to the loss in favourable soil structural properties. In the humid forest zone of Nigeria the land is characterized by slopes (steep lands). As a result of poverty, scarcity of arable land and population pressure particularly in this region steep land (marginal soils) otherwise not suitable for farming activities is increasingly being cleared of natural vegetation for farming. As the existing vegetation is being removed for cultivation and the soil surface exposed and made loose by tilling, with the on-set of the rains, raindrops beat the soil causing soil detachment and destruction of the structural properties (Tulu, 2002). The particles are gradually moved and carried from one location to another by run-off water and where the velocity of the run-off reduces it drops heavier particles/sediments carrying along smaller particles down the slope until it empties at the valley bottom. Silt deposition in down streams are becoming more frequent and more severe (Tulu, 2002). As this process continues, the top soil is washed down slope leaving the sub-soil at the crest of the slope. Often, dynamic physical properties like bulk density, hydraulic conductivity, soil

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