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Soil organic carbon and nutrients losses form the sloping land in the scenario of water erosion in the south of Rwanda

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Abstract: Rwanda is located in the plateau of the central-eastern Africa nearby the equator of the Earth, known as 'The Land of a Thousand Hills', and covers the part of the region of the Upper Nile. The sloping lands are ubiquitous across Rwanda, and the sloping farmlands account for more than 70 per cent of the sloping land resources. The soil and water losses are very severe on the sloping lands, especially on the sloping farmlands due to the farming activities and soil water erosion induced by the erosive rainfall events. Therefore, the soil erosion and soil organic carbon (SOC) and nutrient losses and the resultant soil deterioration and crop yield decline on the sloping farmlands in this country have attracted the widespread concerns. It is necessary to understand severity of the SOC and nutrient losses on the sloping farmland due soil erosion in term of launching the countermeasure to control the losses. The investigation on the SOC and nutrient losses in the sloping farmlands and the rainfall was carried out on the runoff plot with 20m long, 5m wide and gradient of 12° in Rubona, Huye District, south province of Rwanda. The cropping rotation of soybean-maize-groundnut was practiced on the plot during the monitor on soil losses from the plot. The contents of constituents of soils lost from the plot decreased in the order: SOC > total potassium (TK) > total nitrogen (TN) > total phosphorus (TP). The loss intensities of SOC from the plot varied from 383.0 kg/hm² to 1680.9 kg/hm² in the period from 2011 to 2013, 259.4 kg/hm² to 1138.5 kg/hm² for TK, 41.2 kg/hm² to 180.8 kg/hm² for TN, 9.2 kg/hm² to 40.2 kg/hm² for TP. The loss intensities of SOC, TK, TN and TP were 1262.3 kg/hm², 99.0 kg/hm², 99.4 kg/hm², 35.4 kg/hm² in 2017, and 3786.8 kg/hm², 2970.0 kg/hm², 298.1 kg/hm² and 106.3 kg/hm² in 2018, respectively. The loss intensities of SOC and nutrients varied significantly over the years. It can be seen that the amounts of erosive rainfall have the crucial impacts on loss intensities of SOC and nutrients through analyzing the relation between loss intensities and erosive rainfall. The relations between loss intensities of SOC and nutrients and mounts of erosive rainfall can be described by exponential function. Compared with the loss intensities of SOC and nutrients on the runoff plot, the loss intensities were much less on the plots with the corresponding soil and water conservation measures such as terracing and plant hedges. Therefore, the measures of anti-erosion should be adopted on the sloping farmlands in an effort to reduce SOC and nutrient

losses and keep the sustainable soil productivity in Rwanda.

Keywords: SOC; nutrient; sloping farmland, Rwanda