

Tropentag, September 9-11, 2020, virtual conference

"Food and nutrition security and its resilience to global crises"

Prediction of Soil Erosion under Three Tillage Systems Using RUSLE and GUEST Models

G. ESAIE KPADONOU¹, SAMUEL KWASI GODFRIED ADIKU¹, DILYS SEFAKOR MACCARTHY²

¹University of Ghana, Dept. of Soil Science, Ghana

²University of Ghana, Soil and Irrigation Research Centre, Ghana

Abstract

Soil erosion is a major challenge to sustained agricultural production in the tropics. The severity of erosion is linked with the type of tillage. Yet, data and estimates of erosion under different tillage and land management systems are lacking. In this study, soil erosion under three tillage practices: namely (i) flat tillage, TF, (ii) ridge and furrow tillage, RF, and (iii) tied-ridge tillage, TR, were investigated using lysimeters. Maize (Zea mays) was cultivated on the lysimeters and data on water balance components and soil loss were collected over two growing seasons with varied rainfall amounts. In order to extrapolate findings to other situations, the Revised Universal Soil Loss Equation (RUSLE), one of the most widely used soil erosion model, and the Griffith University Erosion Simulation Template (GUEST) were used to simulate soil loss under the three tillage systems. The results showed that runoff to rainfall ratio were in the range of 41.3-32.3%, 34.9-24.0% and 15.0-0.0% for RF, FT and TR, respectively, during the first (major) and the second (minor) season. Hence, the runoff order was RF > FT > TR. Similarly, soil loss followed the same order as runoff. TR significantly reduced soil loss by 43% compared to RF during the major season. In the minor season TR recorded zero soil loss. In general, soil loss during the major season was 25-75% higher than that of the minor season. Both models predicted the soil erosion well and captured the differing tillage effects. Comparisons between observed and simulated erosion were generally good. We conclude that modelling can enable the prediction of the impact of tillage type on soil erosion under varying soil management conditions and this could support agricultural planning for different agro-ecological zones.

Keywords: Conservation tillage, erosion, modelling, tillage

Contact Address: G. Esaie Kpadonou, University of Ghana, Dept. of Soil Science, Legon Campus University of Ghana, Accra, Ghana, e-mail: e.kpadonou@yahoo.com