

Assessment of Tillage Erosion Rates on Steepland Oxisols in the Humid Tropics Using Granite Rocks

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ABSTRACT

Soil translocation by animal-powered tillage may lead to land degradation in small scale steep-land agriculture in the humid tropics. This study evaluated tillage-induced soil translocation on an Oxisol with 25 and 36% slopes in Claveria, Philippines. The three tillage systems were contour moldboard plowing (CMP), moldboard plowing up and downslope (UMP), and contour ridge tillage (CRT). Rocks 3 to 4 cm in "diameter" used as soil movement detection units (SMDU) were placed at 10-cm intervals in a narrow 5-cm-deep trench near the upper boundary of each plot, the position of each rock recorded, and the trench backfilled. Five tillage operations used to produce one corn (*Zea mays* L.) crop were performed during a one month period: two moldboard plowing operations for land preparation (except for CRT), one moldboard plowing for corn planting, and two inter-culture (inter-row cultivation) operations. After these operations, over 95% of the SMDU were recovered manually, their exact locations recorded, and their movement used to estimate soil transport due to tillage. Mean annual soil flux for the 25% slope was 365 and 306 kg m⁻¹ yr⁻¹ for UMP and CMP, respectively. For the 36% slope, comparable values were 481 and 478 kg m⁻¹ yr⁻¹. Estimated tillage erosion rates for the 25% slope were 456 and 382 Mg ha⁻¹ yr⁻¹ for UMP and CMP, respectively, and increased to 601 and 598 Mg ha⁻¹ yr⁻¹, respectively, for the 36% slope. The mean displacement distance, mean annual soil flux, and mean annual tillage-induced soil loss for both slopes were reduced by approximately 70% on both slopes using CRT compared to CMP and UMP. The present rapid rate of land degradation by moldboard plowing could be dramatically reduced with the adoption of ridge tillage.

INTRODUCTION

Moldboard plowing in intensive mechanized farming systems erodes topsoil and reduces the productive potential of soil resource (Veseth, 1986). This process also occurs under small scale farming systems in the humid tropics where animal-powered moldboard plowing is performed (Garrity, 1996). In alley cropping, topsoil generally moves downslope from the upper part of the alley and accumulates in the lower portions of alley. As a result, terraces develop between adjacent vegetative barrier strips within a few years (Agus et al., 1997). One consequence of this soil movement is that crop productivity decreases in the upper portion of the alley and increases in the lower portion of the alley (Thapa, 1997).

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