



Vegetation effects on soil water erosion rates and nutrient losses at Santa Catarina highlands, south Brazil

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Water erosion involves three main processes: detachment, transport and deposition of soil particles. The main factors affecting water erosion are rainfall, soil, topography, soil management and land cover and use. Soil erosion potential is increased if the soil has no or very little vegetative cover of plants and/or crop residues, whereas plant and residue cover substantially decrease rates of soil erosion. Plant and residue cover protects the soil from raindrop impact and splash, tends to slow down the movement of surface runoff and allows excess surface water to infiltrate. Moreover, plant and residue cover improve soil physical, chemical and biological properties. Soils with improved structure have a greater resistance to erosion. By contrast, accelerated soil erosion is accentuated by deforestation, biomass burning, plowing and disking, cultivation of open-row crops, etc. The erosion-reducing effectiveness of plant and/or residue covers depends on the type, extent and quantity of cover. Vegetation and residue combinations that completely cover the soil are the most efficient in controlling soil. Partially incorporated residues and residual roots are also important, as these provide channels that allow surface water to move into the soil. The effectiveness of any crop, management system or protective cover also depends on how much protection is available at various periods during the year, relative to the amount of erosive rainfall that falls during these periods. Most of the erosion on annual row crop land can be reduced by leaving a residue cover greater after harvest and over the winter months, or by inter-seeding a forage crop. Soil erosion potential is also affected by tillage operations and tillage system. Conservation tillage reduces water erosion in relation to conventional tillage by increasing soil cover and soil surface roughness. Here, we review the effect of vegetation on soil erosion in the Santa Catarina highlands, south of Brazil, under subtropical climatic conditions. The area cropped under no tillage in Brazil has increased rapidly since 1990, especially in the southern region. This practice was first introduced in the 1970s as a strategy to control soil erosion and continuous declines in land productivity under conventional tillage systems. No tillage almost entirely keeps the previous crop residue on the surface. In the last 15 years soil and water losses by water erosion have been quantified for different soil tillage systems, diverse crop rotations and successive crop stages under simulated and natural rain conditions. Plot experiments showed that soil losses under no tillage systems with a vegetative cover were 98% lower when compared with conventionally tilled bare soil. Moreover water losses were 60% lower for these conditions. Conventional tillage (plowing + harrowing) in the presence of vegetative cover reduced soil losses and water losses by 80% and 50%, respectively, taken the uncultivated bare soil as a reference. The review includes the effect of vegetative cover on nutrient losses at the studied sites in the Santa Catarina highlands.