Deutscher Tropentag, October 8-10, 2003, Göttingen

"Technological and Institutional Innovations
for Sustainable Rural Development"

Soil Crusting and Sealing in the Andean Hillsides of Colombia and its Impact on Water Infiltration

Christian Thierfelder[1], Karl Stahr[1], Amezquita C. Edgar[2]

[1] *University of Hohenheim, Department of Soil Science, Germany*
[2] *Centro Internacional de Agricultura Tropical (CIAT), Department of Soil Science, Colombia*

Abstract

Soil erosion is a major global problem. Apart from climatic reasons, major causes are inappropriate land-use and improper fertilizer management as well as socio-economic constraints. In order to acquire a basic knowledge of soil degradation and to design sustainable cropping systems in the tropics, efforts have been made to investigate soil crusting and sealing as primary factors of soil deterioration. Both phenomena have a negative impact on water infiltration, reduce air permeability and seedlings emergence. Due to the reduction of water infiltration, the surface run-off increases and in consequence enhances soil erosion. The aim of this research was to investigate negative impact of soil crusting on infiltration. Field trials in an Andean hillside environment with cassava-based cropping systems were established in the southwest of Colombia on an amorphous, isohyperthermic oxic Dystropept (Inceptisol). Measurements have been carried out using a penetrometer to measure penetration resistance and a mini-rain-simulator to investigate water infiltration. Two general types of soil crusts were found. The first emerged due to the destructive impact of raindrops on insufficiently covered soil surfaces and weak superficial soil aggregates. The second type developed through chemical dispersion of clays during the raining season and following forming-up of more pronounced soil crusts and seals during the dry seasons. Andean Inceptisols normally have a good soil structure. Nevertheless, it was found out that chicken manure significantly increased penetration resistance due to soil crusting in the dry season (from $8.3\,\mathrm{kg\,cm^{-2}}$ in a minerally fertilized cassava intensive tillage treatment to $25.3\,\mathrm{kg\,cm^{-2}}$ in a cassava treatment manured with $8\,\mathrm{t\,ha^{-1}}$ chicken manure). Results from field trials showed a destructive impact of chicken manure on soil structure and a reduction of water infiltration. Furthermore, conservation tillage systems like minimum tillage and improved fallow cropping systems improved final water infiltration ($76.6\,\mathrm{mm\,h^{-1}}$ in cassava minimum tillage treatment compared to $42.2\,\mathrm{mm\,h^{-1}}$ in cassava $8\,\mathrm{t\,ha^{-1}}$ chicken manure treatment) and consequently reduced surface run-off. This substantiates the hypothesis that inappropriate fertilizer management and unsustainable cropping systems are the key factors of structural deterioration on Inceptisols in the Andes of Colombia.

Keywords: Chicken manure, inceptisols, infiltration, soil erosion, tillage system

Contact Address: Christian Thierfelder, University of Hohenheim, Department of Soil Science, Private Address: Neue Straße 1, 73779 Deizisau, Germany, e-mail: christian.thierfelder@debitel.net