Geophysical Research Abstracts, Vol. 9, 03743, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03743

Are redox-patterns of Stagnosol subsoils related to preferential flow paths?

M. Martins da Silva (1), S. Köhne (2), J. M. Köhne (2) and B. Lennartz (2)

(1) Department of Exact Sciences/Agro-Environmental Physics, ESALQ, University of Sao Paulo, Brazil, (2) Institute for Land Use, University Rostock, Germany, sigrid.koehne@uni-rostock.de / +49 381 4983185

Stagnosols are common soils of the moraine landscapes of the Baltic Region. Considerable losses of nutrients and agrochemicals mainly caused by preferential flow have been detected for such soils. Diagnostic properties of Stagnosols are the mottled color patterns of the subsoil arising from redox processes as induced by temporary water saturation due to low hydraulic conductivities. Prolonged water saturation in soils with rather stagnant water induces oxygen deficit, thereby causing reduction and dissolution of iron and manganese, leaving behind bleached, pale soil areas. The reddish colors of the mottled patterns show the local zones of predominantly oxidizing conditions, i.e., the soil regions with less resistance to drainage after a water logging period, and lower average water contents. Our objective was to investigate i) if the chemical redox pattern observed in a Stagnosol subsoil is related to the preferential flow pattern as visualized by dye tracing, and ii) if the observed flow pattern is related to selected local soil physical properties. Dye tracing experiments were carried out by means of tension and ponded infiltration of Brilliant Blue (BB) on a Stagnosol. The resulting color patterns (reddish, bleached and blue areas) of 10 vertical subsoil profiles were mapped and sampled to determine local values of bulk density (ρ), volumetric water content (θ) and penetration resistance (PR). The data were explored using image analysis and statistics. The dye patterns resulting from both ponded and tension infiltration showed that preferential flow regions (blue areas) were predominantly bound to biological structures (worm burrows, decaying roots) and thus were not directly related to the mottled pattern. Prior to infiltration, we observed significantly higher θ in bleached areas as compared to reddish areas. After infiltration, however, θ of red or blue areas could not be distinguished from θ of bleached areas. Hence, water transfer

from blue flow paths to adjacent reddish areas had taken place. However, BB was adsorbed in the biological flow paths and thus did not visualize the water transfer. The PR was significantly smaller for blue stained flow paths as compared to reddish and white areas. However, the measurement of ρ was too insensitive to support that the lower PR of the blue pathways was linked to lower ρ, i.e. higher porosities. At our site, deep rooting crops may have superimposed the natural relation between mottled colors and flow pattern. Therefore, further investigations should focus on Stagnosols with, e.g., grass cover.