Geophysical Research Abstracts, Vol. 7, 01105, 2005
SRef-ID: 1607-7962/gra/EGU05-A-01105

Plant rooting and water infiltration into an old buffer zone and an adjacent cultivated soil

L. Pietola (1), M. Yli-Halla (2)

(1) University of Helsinki, Department of Applied Chemistry and Microbiology, Finland, (2) MTT Agrifood Research Finland, Jokioinen, Finland (liisa.pietola@helsinki.fi)

Macropores are the main paths for infiltration into wet soils. Under Nordic conditions, high infiltration capacity through macropores is crucial during early spring or late autumn when high water fluxes occur in nearly water saturated soil. Destroyed soil structure, however, increases ponding of water and surface runoff and, consequently, vulnerability of soil to water erosion. Additionally, blocking of pores by roots may affect water infiltration. Under vegetation, also soil hydrophobicity modifies water flows. Thus, although plant growth ameliorates soil structure by producing root channels and exudates, vegetation does not necessarily increase water movement through soil. This may be a serious issue in old buffer zones and permanent pastures.

To study the impact of vegetation to water movement, related soil properties were studied in early spring at a 10-years old buffer zone which was vegetated with grasses and mosses, and adjacent field which was ploughed in the previous autumn and is continuously cropped with spring-sown small grains. The soil had 60% of clay. Infiltration rate through initially dry soil surface was measured by using four large cylinders (∅ 80 cm, height 20 cm) per site (Pietola et al. 2004). For measurements of soil macroporosity, eight cylinders (∅ 7 cm, height 5 cm) per site and soil depth (0-5 cm, 10-15 cm, 20-25 cm, 30-35 cm) were taken after the infiltration measurement. Volumetric water contents were measured at matric suctions of 0, -1, and 10 kPa. For image analysis of washed roots, core samples (∅ 5 cm) were taken at 10 cm-increments to a soil depth of 30 cm (Pietola, 1998). Persistence of potential water repellency was measured on air dried surface soil samples by the water drop (ø 5 mm) penetration time (WDPT) test.

The data showed that 0.25 mm-size roots filled the pores in the buffer zone: In the surface layer (0-10 cm) the root length density (RLD) was 14 cm $cm^{-3}$and the

steady state infiltration flux ($\approx$ saturated hydraulic conductivity K-sat) was 3 cm h^{-1}(S.E.0.2). In the adjacent field the RLD was 0.7 cm cm^{-3} and K-sat 5.0 was cm h^{-1} (S.E. 0.5). Although the buffer zone had slightly more $\geq$0.3 mm-size macropores (7%) than the adjacent field (5%), 50% of the macropore volume was occupied by the root volume in the buffer zone. Additionally, under unsaturated soil conditions, infiltration of the buffer zone was the slowest. This was partly due to its hydrophobicity: According to the interpretation of water drop penetration test (WDPT) by Dekker and Jungerius (1990), the buffer zone was water repellent (WDPT 410 s), but the adjacent cultivated field was not (WDPT < 5 s).

Blocking by roots and hydrophobicity may thus decrease water infiltration under non-compacted conditions. These results demonstrate that vegetation plays an important role in water infiltration and modifies the risk of runoff.

References

Dekker, L.W., Jungerius, P.D., 1990. Water repellency in the dunes with special reference to The Netherlands. Catena Supplement 18, 173-183.

Pietola L. 1998. Tillage and root growth dynamics. In: Proceeding of NJF seminar no. 286 Soil tillage and biology, held 8-10 June in Ås, Norway. NJF-utredning/rapport nr 124: 64-71.

Pietola, L., Horn, R. & Yli-Halla, M. 2004. Effects of trampling by cattle on hydraulic and mechanical properties of soil. Soil and Tillage Research.(available online on 17 November 2004 doi:10.1010/j.still.2004.08.004)