



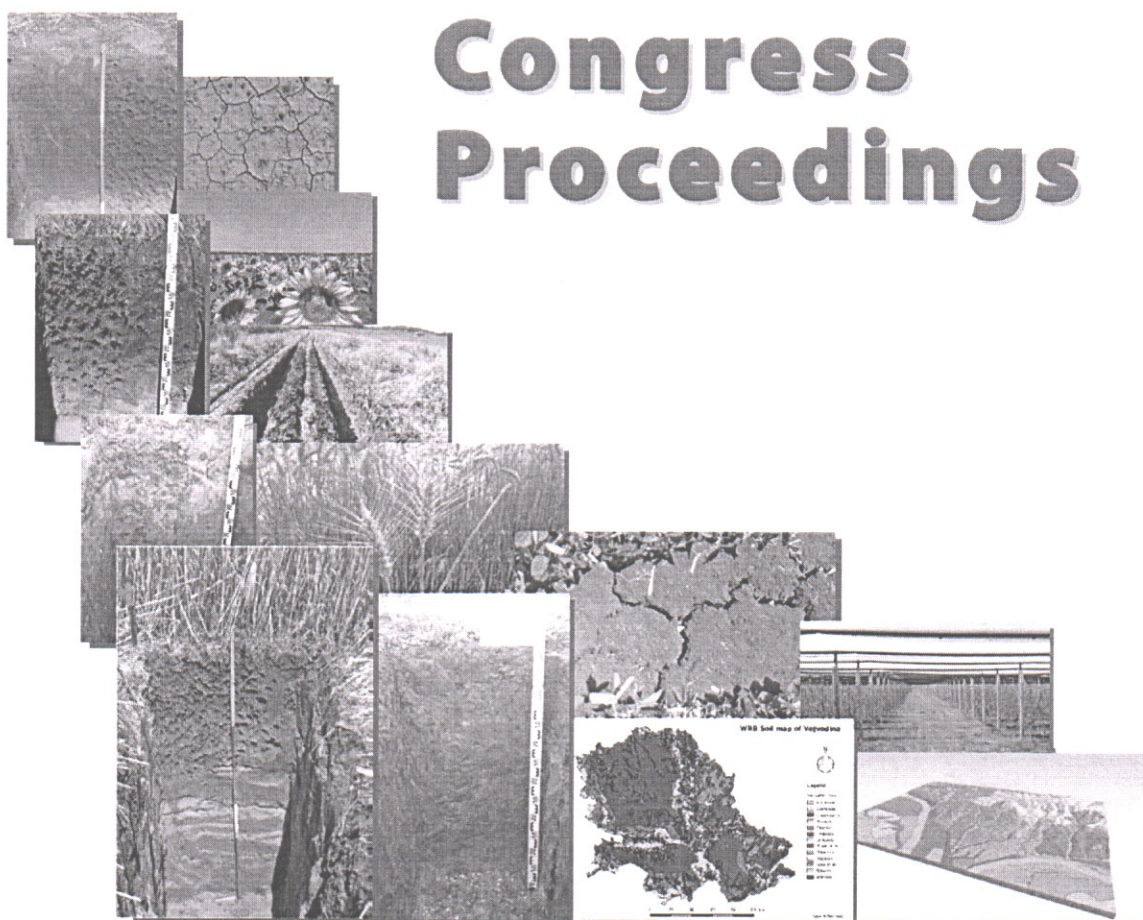
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2nd International and 14th National Congress of Soil Science Society of Serbia

Solutions and Projections for Sustainable Soil Management

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Congress Proceedings



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Water infiltration affected by different land use types and soil texture in temperate climate

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ABSTRACT

Surface soil hydrological properties like water infiltration and hydraulic conductivity have important consequences for hydrological properties of soils in river basins and their knowledge is needed for sound land management, as well as flood risk prevention. They are very dynamic properties due to varying land use management practices. The objective of this study was to evaluate the effects of two land uses (native meadow and arable) on surface (0–30 cm) infiltration characteristics of a silty clay loam and sandy loam soils at three sites in the Kolubara river valley and the Nišava river valley, respectively, with temperate climate, Serbia.

A site consisted of two adjacent but different land uses on the same soil types. For each land use, water infiltration rates were measured in triplicate using double ring infiltrometer. Particle size distribution, bulk density and soil organic matter content of the surface soil were determined.

Experimental measurements in the field indicated that treatments significantly influenced water infiltration characteristics on both locations. At both site the infiltration rates showed a decrease as a function of elapsed time. Steady state infiltration rate and cumulative infiltration of sandy loam-textured soils under the meadows were much lower than that for the arable soils. By contrast, the infiltration capacity and cumulative infiltration of silty clay loam soils under the meadows was significantly ($P < 0.05$) higher compared to arable soils. Increase in infiltration capacity of arable soils were related to decrease in bulk density. In addition, in tilled sandy loam soil infiltration was much higher than in silty clay loam soil. However, infiltration in a silty clay loam under meadow was lower compared with sandy loam soil. According to the results of our study it could be concluded that the land use change infiltration properties of surface soil and consequently may alter the water balance of the area by changing the amount of surface runoff and soil water retention. Knowledge of how management practices affect infiltration capacity can aid growers in reducing soil quality and degradation.

KEY WORDS: vegetation change; meadow; arable land; Fluvisols, surface soil

INTRODUCTION

Numerous human activities can significantly alter land cover properties and subsequently hydrological and watershed processes. Land use change affect physical, chemical and biological properties of soils (Shukla et al., 2003; Yimer et al., 2008). Also, soil management or land use affects soil hydraulic properties, and thus the water balance and hydrology of the land (Bodhinayake and Si, 2004). After tillage a soil results in quick changes in the physical condition of a soil until a new equilibrium is reached. Native meadows represent specific ecosystems that have significant importance for water regime in landscape (Halabuk, 2006). Their character, especially expressed through soil physical properties and vegetation have influence on hydrological processes, e.g. infiltration, water retention and evapotranspiration (Bullock and Acreman, 2003). However, native meadows were extensively destroyed and transformed to arable lands in the past. Recently, there has been a higher interest for studying these ecosystems to get the knowledge of their multiple importance. Land use change from natural vegetation to arable lands has a marked effect on infiltration, water transport characteristics and surface runoff (Tollner et al., 1990; Broersma et al., 1995; Gajić et al., 2008; Yimer et al., 2008). Grain size distribution strongly influences hydraulic properties of soil, and therefore texture has often been related to hydraulic conductivity (Saxton et al., 1986).

The measurement of water infiltration into the soil is an important indication in the regards of the efficiency of drainage and irrigation, improving the yield of crops, optimizing the availability of water for plants, minimizing water erosion and describing the soil permeability (Selim, 2011). Also, knowledge of the land use impacts on soil quality is necessary for sustainable agricultural production.

Effects of land use on infiltration characteristics, particularly in the river valleys, have not been documented in the Serbian Fluvisols to the best of our knowledge. This information is needed for