

Infiltration characteristics of volcanic sloping soils on Mt. Elgon, Eastern Uganda

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Abstract

Water infiltration is an important hydrological process that influences runoff and soil loss patterns in mountain ecosystems. In this paper, we present results on spatial variation in infiltration in croplands on the volcanic soils of Mt. Elgon, in Eastern Uganda. Twelve experimental sites with slope gradients ranging from 12 to 32% were established. Infiltration tests were carried out with a double ring infiltrometer and three measurements were taken at the upper, middle and lower sections of each experimental site to assess the local variability of infiltration. In addition soil information was collected on each experimental site. The soil infiltration data were then evaluated to fit to four commonly used water infiltration models: (1) Philip (1957), (2) Green–Ampt (1911), (3) Horton (1940) and (4) Kostiaikov (1932). The twelve experimental sites cover two cropping systems: annual (6 sites) and perennial (6 sites) crops. Based on the results, we examine the spatial variability of infiltration, the relationship of infiltration to landscape position, and the influence of soil composition on infiltration rates on the slopes. The factors affecting spatial variability of soil infiltration were analysed using correlation and regression techniques. Steady state infiltration rates generally increased with the slope gradient and were crop type independent ($P < 0.05$). The performance of the four applied water infiltration models was generally good with mean R^2 values ranging from 0.79 to 0.87, although all the models tended to over-predict the steady state infiltration rates at most sites. Overall, the Philip's and Kostiaikov gave better results than the Horton and Green–Ampt models in reproducing the infiltration process on Mt. Elgon.

Keywords

- Water infiltration;
- Infiltration models;
- Volcanic soils;
- Mt. Elgon

