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### The Thickness of the Shallow-Depth Hardpans on Soil Hydraulic Characteristics

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#### Abstract

Soil-water relations in terrestrial ecosystems are characterized by the set of attributes collectively referred to as soil hydraulic characteristics. Soil hydraulic characteristics play an important role in determining the capacity of soil to serve the crop growth and ecosystem. Subsurface compaction in soil or shallow depth hardpan development, which can vary from a few millimeters to meters, is one of the crucial factors that determine soil hydraulic characteristics. However, information lacks on how the thickness of the hardpan (THP) influences the soil hydraulic characteristics of the soil. Therefore, this study was aimed to assess the effects of THP on the initial infiltration rate ( $I_i$ ), unsaturated hydraulic conductivity ( $K_{UNSAT}$ ) and sorptivity ( $S_w$ ) of soil using moderate thickness levels of 1 (THP<sub>1</sub>), 3 (THP<sub>3</sub>) and 5 cm (THP<sub>5</sub>), prepared using 1.7 g cm<sup>-3</sup> bulk density and with 0 cm as the control (without hardpan). The soil used in the study was collected from the field in the Faculty of Agriculture, University of Ruhuna (6° 03 '29"N 80° 34' 13"E). The area is in the low country wet zone (WL2) agro-ecological region. PVC tubes with 10.5 cm inner diameter and 30 cm in height were used to prepare the soil columns used in the experiment. The readings were taken in triplicates, using Mini disk infiltrometer. The depth to the hardpan from the surface was kept at 3 cm. All soil columns with hardpans showed significantly low  $I_i$ ,  $K_{UNSAT}$  and  $S_w$  values compared with the control. The highest  $I_i$ ,  $K_{UNSAT}$  and  $S_w$  showed in the control, and it was about 60 cmh<sup>-1</sup>, 21 cm h<sup>-1</sup> and 0.14 cms<sup>-1</sup> respectively. The  $I_i$ ,  $K_{UNSAT}$  and  $S_w$  in soil columns gradually decreased with the increase of THP.  $I_i$  of soil columns with THP<sub>5</sub> showed approximately 4.5% reduction than the THP<sub>3</sub>. The  $K_{UNSAT}$  of soil columns with THP<sub>3</sub> showed approximately 29.5% reduction and 42% increment than those soil columns with THP<sub>1</sub> and THP<sub>5</sub> respectively. The results revealed that the presence of soil hardpans has a negative influence on  $I_i$ ,  $K_{UNSAT}$  and  $S_w$ , even THP<sub>1</sub> can significantly reduce the water movements in the soil matrix. Furthermore, it was clear that THP<sub>3</sub> and THP<sub>5</sub> can reduce water movements to almost negligible levels, which would create subsurface water-logging conditions.

**Keywords:** *Hardpan, Thickness, Subsurface, Infiltration, Hydraulic conductivity*