

(011)

Effects of Repeated Application of Organic Amendments on Water Repellency, Initial Infiltration and Hydraulic Conductivity of Soil Under Field Conditions

Rajapaksha, R.A.N.D.¹, Leelamanie, D.A.L.^{1*}, Mori, Y.², Liyanage T.D.P.¹

¹Faculty of Agriculture, University of Ruhuna, Kamburupitiya, Sri Lanka

²Graduate School of Environmental and Life Science, Okayama University, 3-1-1, Tsushima-Naka, Kita-Ku, Okayama 700-8530, Japan

*leelamanie@soil.ruh.ac.lk

Abstract

The application of various organic amendments is a common practice in agriculture to enhance soil organic matter content. Soil Water Repellency (SWR) is a phenomenon that restricts water movement in soil, which is caused by the presence of organic substances. The application of organic amendments to soil can alter the water-repellent nature of the soil, potentially causing negative impacts on soil hydraulic functions. Comprehensive evidence on the possibility of the development of SWR to detrimental levels through repeated applications of organic amendments and consequent effects on the soil hydraulic dynamics is highly limited. The present study aimed to examine the development of SWR and the impacts on initial infiltration (I_i) and unsaturated hydraulic conductivity (k) of soil through the repeated application of repellent and non-repellent organic amendments. The experiment was conducted as a field experiment with 20 raised bed plots (0.25 m² area per plot). The 3% (w/w) of compost (COM), cattle manure (CM), paddy husk biochar (BC_{PH}), and casuarina leaf litter biochar (BC_{CE}) were used as three repeated applications per year (4-month interval). SWR was assessed using the water drop penetration time (WDPT) test, while I_i and k were measured in the field using a mini disk infiltrometer. The results indicated that soil remained non-repellent (WDPT < 5s) with repeated applications of organic amendments, though extremely water-repellent BC_{CE} showed an increasing trend in SWR. Initially, soils with CM and BC_{CE} had the lowest I_i , while the control had the highest. Over time, I_i increased in CM and BC_{CE} soils with no significant difference between them. The k showed a slightly decreasing trend with the application of COM, CM, and BC_{CE}, where BC_{CE} resulted in a more pronounced decline (a 48% decline compared to the control after 1 year). Results confirmed that the tested application level did not create negative levels of SWR. The loamy sand soil is typically associated with high k , which may lead to the leaching of agrochemicals and nutrients from the root zone. The observed decrease in k with the application of organic amendments may therefore be beneficial by reducing the leaching effect and groundwater contamination. Thus, despite concerns over repeated application of organic amendments, the finding highlights the positive effect of reduced k in soils with initially high hydraulic conductivity.

Keywords: *Organic amendments, Water repellency, Infiltration, Unsaturated hydraulic conductivity*