

Abstract

# Assessing Soil Crack Dynamics and Water Evaporation during Dryings of Agricultural Soil from Reduced Tillage and Conventional Tillage Fields <sup>†</sup>

Njaka Ralaizafisoloarivony <sup>1,\*</sup>, Aurore Degré <sup>2</sup>, Benoit Mercatoris <sup>3</sup>, Angélique Leonard <sup>4</sup>, Dominique Toye <sup>4</sup> and Robert Charlier <sup>5</sup>

<sup>1</sup> University of Liege, 5030 Gembloux, Belgium

<sup>2</sup> Gembloux Agro-Bio Tech, University of Liège, 5030 Gembloux, Belgium; Aurore.Degre@uliege.be

<sup>3</sup> Gembloux Agro-Bio Tech, University of Liège, 5030 Gembloux, Belgium; Benoit.Mercatoris@uliege.be

<sup>4</sup> Chemical Engineering, University of Liège, 4000 Liège, Belgium; A.Leonard@uliege.be (A.L.); Dominique.Toye@ulg.ac.be (D.T.)

<sup>5</sup> Department ArGENCo, University of Liège, 4000 Liège, Belgium; Robert.Charlier@uliege.be

\* Correspondence: ralainja@yahoo.fr

<sup>†</sup> Presented at TERRAenVISION 2019, Barcelona, Spain, 2–7 September 2019.

Published: 19 May 2020

**Abstract:** Crack formation and development have been a general concern in agricultural science. Cracks contribute to soil aeration, aggregate formation, and easy root penetration. However, cracks accelerate soil desiccation, allow deep infiltration of pesticides/pollutants through preferential flow, and pollute the shallow water table in Belgium. Cracks have mostly been studied in pure clay or in high-clay-content soil (Vertisol). Yet, in Wallonia, cracks were also present on silt–loam soil (Luvisol). This study tried to cover this gap by analysing crack dynamics and evaporation process, during drying kinetics of the Luvisol. Soils were collected directly from the agricultural field and processed on a small drying chamber in which an evaporation test took place. A ceramic IR emitter heated the chamber while sensors (DHT22) measured the temperature and relative humidity. A digital camera took photos of the soil surface at 30-min intervals. A balance and tensiometer were linked to a datalogger (CR800), and recorded the soil hydraulic properties (evaporation rate, etc.). Cracks were assessed from small samples (~5 cm × 1 cm thick) and big samples (~20 cm size × 1.6 cm thick). Three treatments were considered, including disturbed soil, conventional tillage and reduced tillage. For big samples, results showed higher crack formation on disturbed soil > reduced tillage > conventional tillage, due to loose soil cohesion, soil organic content, soil aggregation, biological activities, and soil porosity. The soil evaporation rate was also greater in disturbed soil > reduced tillage > conventional tillage. Cracks opening exposed a large quantity of soil water to the atmosphere without it passing through the soil matrix. For small samples, the repetitive drying experiments increased cracks' length and width, especially for the dense samples. The results indicated the presence of pre-existing (or micro-) cracks in the soil samples. Future study is needed to assess the presence of pre- (micro-) cracks in soil using X-ray microtomography.

**Keywords:** soil cracks; drying kinetic; evaporation; reduced tillage; conventional tillage



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