



Effects of the duration of water saturation periods on organic carbon mineralization in a poorly-drained mineral soil

Emmanuel Tete (1), Valérie Viaud (1), and Christian Walter (2)

(1) INRA UMR 1069 SAS, F-35000 Rennes, France, (2) Agrocampus-Ouest UMR 1069 SAS, F-35000 Rennes, France

In poorly-drained soils located in riparian areas, climate change is likely to affect the duration and frequency of water saturation periods and consequently rates of soil organic matter mineralization in these soils. Using laboratory incubations of an epistagnic Haplic Albeluvisol, the aim of this study was to quantify the effect the duration of water saturation periods on soil organic C (SOC) and N mineralization under saturated and non-saturated conditions.

120 undisturbed soils cores were incubated at 20°C during 64 days. Three treatments differing in the duration of the water saturation periods were considered. In the control treatment (T0), the soil water content was maintained at field capacity (71% WFPS) throughout the duration of the incubation. In treatment T1, the soil was saturated (100% WFPS) during 46 days, and desaturated and soil water content was maintained at field capacity until the end of incubation. In treatment T2, the soil was saturated (100% WFPS) during 19 days, and desaturated and soil water content was maintained at field capacity until the end of incubation. For each treatment, gas analyses (CO₂) were performed at 10 dates on four replicates.

SOC mineralization in T1 and T2 was low during the saturation phase (median value 2.7 and 1.5 mgC-CO₂.kg⁻¹.d⁻¹ respectively) compared to that of the control treatment (median value 4.5 and 4.1 mgC-CO₂.kg⁻¹.d⁻¹ respectively at 46th and 19th day) and that of the desaturated phase of T1 and T2 (median value 7.9 and 3.6 mgC-CO₂.kg⁻¹.d⁻¹ respectively). In T1, CO₂ concentration at the beginning of desaturation twice higher than that observed in the control treatment. The results also showed that whatever the duration of saturation periods SOC mineralization in T1 and T2 at desaturated condition was similar to that of T0. However, the SOC mineralized on the whole 64 days of incubation was 45% less important for T1 and T2 than T0.

This study showed that the duration of water saturation periods not affected organic carbon mineralization neither at saturated nor desaturated condition. In saturation condition carbon mineralization was provided by nitrate reduction respiration and desaturation beginning caused a flush of aerobic respiration. All these processes were not time depending but strongly linked to soil moisture and soil redox conditions.