World Academy of Science, Engineering and Technology
International Journal of Agricultural and Biosystems Engineering
Vol:17, No:11, 2023

# The Intensity of Root and Soil Respiration Is Significantly Determined by the Organic Matter and Moisture Content of the Soil

**Authors :** Zsolt Kotroczó, Katalin Juhos, Áron Béni, Gábor Várbíró, Tamás Kocsis, István Fekete

**Abstract :** Soil organic matter plays an extremely important role in the functioning and regulation processes of ecosystems. It follows that the C content of organic matter in soil is one of the most important indicators of soil fertility. Part of the carbon stored in them is returned to the atmosphere during soil respiration. Climate change and inappropriate land use can accelerate these processes. Our work aimed to determine how soil CO2 emissions change over ten years as a result of organic matter manipulation treatments. With the help of this, we were able to examine not only the effects of the different organic matter intake but also the effects of the different microclimates that occur as a result of the treatments. We carried out our investigations in the area of the Síkfőkút DIRT (Detritus Input and Removal Treatment) Project. The research area is located in the southern, hilly landscape of the Bükk Mountains, northeast of Eger (Hungary). GPS coordinates of the project: 47°55′34″ N and 20°26′ 29″ E, altitude 320-340 m. The soil of the area is Luvisols. The 27-hectare protected forest area is now under the supervision of the Bükki National Park. The experimental plots in Síkfőkút were established in 2000. We established six litter manipulation treatments each with three 7×7 m replicate plots established under complete canopy cover. There were two types of detritus addition treatments (Double Wood and Double Litter). In three treatments, detritus inputs were removed: No Litter No Roots plots, No Inputs, and the Controls. After the establishment of the plots, during the drier periods, the NR and NI treatments showed the highest CO2 emissions. In the first few years, the effect of this process was evident, because due to the lack of living vegetation, the amount of evapotranspiration on the NR and NI plots was much lower, and transpiration practically ceased on these plots. In the wetter periods, the NL and NI treatments showed the lowest soil respiration values, which were significantly lower compared to the Co, DW, and DL treatments. Due to the lower organic matter content and the lack of surface litter cover, the water storage capacity of these soils was significantly limited, therefore we measured the lowest average moisture content among the treatments after ten years. Soil respiration is significantly influenced by temperature values. Furthermore, the supply of nutrients to the soil microorganisms is also a determining factor, which in this case is influenced by the litter production dictated by the treatments. In the case of dry soils with a moisture content of less than 20% in the initial period, litter removal treatments showed a strong correlation with soil moisture (r=0.74). In very dry soils, a smaller increase in moisture does not cause a significant increase in soil respiration, while it does in a slightly higher moisture range. In wet soils, the temperature is the main regulating factor, above a certain moisture limit, water displaces soil air from the soil pores, which inhibits aerobic decomposition processes, and so heterotrophic soil respiration also declines.

**Keywords :** soil biology, organic matter, nutrition, DIRT, soil respiration
**Conference Title :** ICSSPN 2023 : International Conference on Soil Science and Plant Nutrition
**Conference Location :** Kyoto, Japan
**Conference Dates :** November 20-21, 2023