Geophysical Research Abstracts
Vol. 12, EGU2010-8552, 2010
EGU General Assembly 2010

Effects of two abiotic factors and their interaction on Soil Carbon Dioxide flux

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Soils release more carbon per annum than current global anthropogenic emissions (Luo and Zhou, 2006). Soils emit carbon dioxide through mineralization and decomposition of organic matter and respiration of roots and soil organism (Houghton 2007) Evaluation of the effects of abiotic factors on microbial activity is of major importance in the context of mitigation greenhouse gases emissions. One of the key greenhouse gases is carbon dioxide (CO2) and previous studies demonstrate that soil CO2 emission is significantly affected by temperature and soil water content. There are a limited number of studies that examine the impact of bulk density and soil surface characteristics as a result of exposure to rain on CO2 emission, however, none examine their relative importance. Therefore, this study investigated the effects of soil compaction and exposure of the soil surface to rainfall and their interaction on CO2 release. We conducted a factorial soil core experiment with three different bulk densities (1.1 g cm-3, 1.3 g cm-3, 1.5 g cm-3) and three difference exposures to rainfall (no rain, 30 minutes and 90 minutes of rainfall). Water was poured on to the cores not exposed to rain and those exposed for 30 minutes through a gauze to ensure all cores received the same volume of water. Immediately the rainfall treatments the soil cores were incubated and soil CO2 efflux and water content were measured 1, 2, 5, 6, 9, and 10 days after the start of the incubation. The results indicate soil CO2 emissions and rate changes significantly through time and with different bulk densities and rain exposures. The relationship between rain exposure and CO2 is positive: CO2 emission was 53% and 42% greater for the 90 min and 30 min rainfall exposure, respectively, compared to those not exposed to rain. Bulk density exhibited a negative relationship with CO2 emission: soil compacted to a bulk density of 1.1 g cm-3 emitted 32% more CO2 than soil compacted to 1.5 g cm-3. Furthermore we found that the magnitude of CO2 effluxes depended on the interaction of these two abiotic factors. Given these results, understanding the influence of soil compaction and raindrop impact on CO2 emission could lead to modified soil management practices which promote carbon sequestration.

Key Words: Soil Carbone Dioxide flux, Rain exposure, Soil Compaction.