

Effect of compaction on soil CO₂ and CH₄ fluxes from tropical peatland in Sarawak, Malaysia

ABSTRACT

Tropical peatland stores a large amount of carbon (C) and is an important C sink. In Malaysia, about 25% of the peatland area has been converted to oil palm plantation where drainage, compaction and groundwater table control are prerequisite. To date, relationship between land compaction and C emission from tropical peatland is scarcely studied. To understand the effect of compaction on soil carbon dioxide (CO₂) and methane (CH₄) flux from tropical peatland, a laboratory soil column incubation was conducted. Peat soil collected from a Mixed Peat Swamp forest were packed in polyvinyl chloride pipes to three different soil bulk densities (BD); 0.14 g cm⁻³, 0.18 g cm⁻³ and 0.22 g cm⁻³. Soil CO₂ and CH₄ flux from the soil columns were measured on weekly basis for twelve weeks. Total soil porosity and moisture retention of each soil BD were also determined using another set of peat sample packed into 100 cm³ soil core ring. Soil porosity decreased while soil moisture retention increased proportionally with increasing soil BD. Soil CH₄ flux were reduced approximately by 22% with compaction. On contrary, soil CO₂ fluxes were greater ($P \leq 0.05$) at compacted soil when infiltration and percolation of rainwater become slower with time, until soil moisture becomes limiting factor. This study suggested that compaction affects water movement and gaseous transport in the peat profile, thus influences C emission from peat soil.

Keyword: CO₂ flux; CH₄ flux; Soil compaction; Soil bulk density; Tropical peatlands