Water Table Fluctuation and Methane Emission in Pineapples (Ananas comosus (L.) Merr.) Cultivated on a Tropical Peatland

ABSTRACT

Inappropriate drainage and agricultural development on tropical peatland may lead to an increase in methane (CH_4) emission, thus expediting the rate of global warming and climate change. It was hypothesized that water table fluctuation affects CH_4 emission in pineapple cultivation on tropical peat soils. The objectives of this study were to: (i) quantify CH_4 emission from a tropical peat soil cultivated with pineapple and (ii) determine the effects of water table depth on CH_4 emission from a peat soil under simulated water table fluctuation. Soil CH_4 emissions from an open field pineapple cultivation system and field lysimeters were determined using the closed chamber method. High-density polyethylene field lysimeters were set up to simulate the natural condition of cultivated drained peat soils under different water table fluctuations. The soil CH_4 flux was measured at five-time intervals to obtain a 24 h CH_4 emission in the dry and wet seasons during low- and high-water tables. Soil CH_4 emissions from open field pineapple cultivation were significantly lower compared with field lysimeters under simulated water table fluctuation. Soil CH_4 emissions throughout the dry and wet seasons irrespective of water table fluctuation were not affected by soil temperature but emissions were influenced by the balance between methanogenic and methanotrophic microorganisms controlling CH_4 production and consumption, CH_4 transportation through molecular diffusion via peat pore spaces, and non-microbial CH_4 production in peat soils. Findings from the study suggest that water table fluctuation at the soil–water interface relatively controls the soil CH_4 emission from lysimeters under simulated low- and high-water table fluctuation. The findings of this study provide an understanding of the effects of water table fluctuation on CH_4 emission in a tropical peatland cultivated with pineapple.