Effects of Macropore Structures on Agricultural Soil’s Greenhouse Gases Emission

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Agriculture is not only the important economic sector via production of crop and livestock but also a significant contributor of greenhouse gases emission. In 2010, it contributed slightly more than 10% to total anthropogenic emissions of greenhouse gases, which totaled some 49 billion tonCO_2eq *(Francesco Nicola Tubiello, 2019).* Increasing organic matter stocks in soils reduces atmospheric carbon dioxide *(Nadine Jäger et al, 2011)*, but they may promote emissions of nitrous oxide by providing substrates for nitrification and denitrification and by increasing microbial O_2 consumption or may boost methane emission in anaerobic condition.

Both natural and agricultural wetland contribute an estimated 40 to 50% of total methane emission each year *(G. J. Whiting & J. P. Chanton, 1993)*. According to modern agricultural practices in Southeast Asia’s countries and others such as Japan, Korea, etc., rice is grown in flooding paddy field which reliably generate the great deal of methane in anaerobic condition. To hold maximum water in the fields, hardpan was created under paddy field. This meant that the infiltration to deeper layer was decreased. Meanwhile, roots created macropores played pathways’ role to largely and quickly emit greenhouse gases in soil. It may highly emit greenhouse gases to atmosphere than natural wetland. Increasing greenhouse gases emission is in results of the global warming potential, therefore, study of effects of macropores on the generation process and reduction of soil’s greenhouse gases emission was conducted.

In this study, 1st column experiment was set up for granite decomposition soil (Masa soil) and paddy field soil. Furthermore, 2nd column experiment was conducted for paddy field soil in ponding condition to see the difference between with and without drainage (0.4mm-pinhole). Tubular macropore (1.5mm) and manure were applied to both soil texture in two experiments. Then, methane and carbon dioxide were measured by sensors once a week for 1st experiment and every water-adding time for 2nd experiment.

The 1st experiment results showed that high methane and carbon dioxide emission were observed in paddy field soil in ponding condition. In contrast, low concentration of the gases was observed in Masa soil. The methane and carbon dioxide emission of both soil textures increased in the 1st and 2nd week, then decreased in 3rd week. Both experiments indicated that column with manure showed gases emission much higher than without manure. Thus, organic matter is an important impact factor on the methane and carbon dioxide emission of paddy soil in ponding condition. In addition, macropores played as pathways to emit methane and carbon dioxide with higher concentration of the gases in the columns. This is in accordance with the explanation of K. Kusa et al. (2010). However, the 2nd experiment results also pointed that the methane and carbon dioxide gas emission observed at columns with drain were lower than ones without drain.

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