Methane gas emission from paddy soils affected by water and structural management

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Human activities are said to play a major role in the generation of greenhouse gases, which are the cause of global warming. Methane is one of the most important gases in the agricultural sector, and it is important to consider how to reduce its emission. In this study, we examined whether the generation of greenhouse gases and the state of the soil were affected by differences in soil environmental management in paddy fields, one of the sites of methane generation.
Paddy field soil was packed in PVC columns and flooded for 30 days under the following four conditions: no drainage and no macropores (P5), no drainage and macropores (P6), drainage and no macropores (P7), and drainage and macropores (P8). Carbon dioxide and methane emissions, redox potential, soil moisture, soil temperature, soil surface height, water level of rice field, pH, TOC, TN, iron and manganese concentrations were measured daily. In addition, the contents of TC, TN, iron, and manganese in the soil were examined after the experiment.
When the paddy soil was flooded with water, the reduction state progressed, and the redox potential decreased rapidly in the first 7 days, and the decrease of soil water content, carbon dioxide and methane emission were confirmed. The redox potential decreased the most in the column without both macropores and wastewater (P5), and the reduction was suppressed in the column with both macropores and wastewater (P8). The reduction was suppressed in the column with both macropore and effluent (P8), suggesting that the effluent and macropore supplied oxygen to the soil. The methane producing bacteria are absolute anaerobes, and the gas production was suppressed by only 6 mm of effluent per day.
Soil moisture decreased in all columns immediately after the start of the experiment, and the water level of the rice field increased, suggesting the presence of methane bubbles in the pore space. In addition, the difference in the amount of gas emission between the columns with and without drainage was large. In the column with drainage and no macropores (P7), the gas emission was smaller than that in P8, but the rate of increase in soil surface height was the highest in P7. The decrease in soil moisture was considered to be due to the increase in pore space, and the possibility that not all of the methane produced in P7 was released, but accumulated in the pores. In other words, it is necessary to take into account not only the gas released but also the gas accumulated in the soil pore.
It is clear that the rate of reduction progresses differently in the same soil by changing water management and soil structure, suggesting that drainage and macropores suppress the emission of greenhouse gases. The results suggest that drainage and macropores suppress the emission of greenhouse gases. Methane gas may accumulate in the soil in the form of bubbles.

Keywords: methane, Global warming, macropore, infiltration

