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Screening of Rice Genotypes in Methane and Carbon Dioxide Emissions Under Different Water Regimes

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Abstract : Among the most significant greenhouse gases released from rice fields are methane and carbon dioxide. The primary focus of this research was to quantify CH_4 and CO_2 gas using different 4 rice cultivars, two water regimes, and a recording of soil moisture and temperature. In this study, we hypothesized that paddy field soils may directly affect soil enzymatic activities and physicochemical properties in the rhizosphere soil of paddy fields and subsequently indirectly affect the activity, abundance, diversity, and community composition of methanogens, ultimately affecting CH_4 flux. The experiment was laid out in the randomized block design with two treatments and three replications for each genotype. In two treatments, paddy fields and artificial soil were used. 35 days after planting (DAP), continuous flooding irrigation, Alternate wetting, and drying (AWD) were applied during the vegetative stage. The highest recorded measurements of soil and environmental parameters were soil moisture at 76%, soil temperature at 28.3℃, Bulk EC at 0.99 ds/m, and pore water EC at 1,25, using HydraGO portable soil sensor system. Gas samples were carried out once on a weekly basis at 09:00 am and 12: 00 pm to obtain the mean GHG flux. Gas Chromatography (GC, Shimadzu, GC-2010, Japan) was used for the analysis of CH4 and CO_2. The treatments with paddy field soil had a 1.3℃ higher temperature than artificial soil. The overall changes in Bulk EC were not significant across the treatment. The CH_4 emission patterns were observed in all rice genotypes, although they were less in treatments with AWD with artificial soil. This shows that AWD creates oxic conditions in the rice soil. CO_2 was also quantified, but it was in minute quantities, as rice plants were using CO_2 for photosynthesis. The highest tillering number was 7, and the lowest was 3 in cultivars grown. The rice varieties to be used for breeding are Norin 24, with showed a high number of tillers with less CH_4.

Keywords : greenhouse gases, methane, morphological characterization, alternating wetting and drying
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