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Annual methane emissions of production systems in lowlands of Rio Grande do Sul

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Irrigated rice cultivation, the main productive activity of the lowlands of Rio Grande do Sul, Brazil, constitutes a major anthropogenic source of methane (CH₄) to the atmosphere, contributing to global warming. The production and emission of CH₄ occurs only in a reduced environment, being also associated with the amount of organic carbon (C) available in the soil. Thus, the production systems influence the potential of C incorporation and, therefore, CH₄ emissions from the soil. The objective of this work was to evaluate annual CH₄ emissions in representative production systems of the Rio Grande do Sul lowlands and in a natural area. The study was conducted in a Planossolo (Typic Albaqualf) in Capão do Leão, State of Rio Grande do Sul, Brazil. CH₄ emissions evaluations were performed from June 2015 to May 2016. Three production systems (irrigated rice/fallow, soybean/ryegrass/corn and improved pasture) and a natural area were evaluated. In each area, three greenhouse gas collectors systems (closed static chamber) were distributed, constituting the replications of the treatments. CH₄ fluxes and CH₄ total emissions were measured seasonally (fall/winter period - 2015 and spring/summer period 2015/2016 (summer season)) and throughout the year. During the fall/winter period, there were practically no CH₄ emissions from the soil, regardless of the production system. It was observed alternation between low intensity fluxes and influxes of CH₄. During the summer season, the area cultivated with irrigated rice presented several high peaks of CH₄ emission, due to the anaerobic condition established by soil flood irrigation. The other production systems and the natural area did not presented significant CH₄ emissions during the summer season; the emissions were characterized by low intensity fluxes alternated by eventual CH₄ absorption events. Total CH₄ emissions during the fall/winter period were low for all treatments (irrigated rice/fallow: 7.6 kg CH₄ ha⁻¹; natural area: 6.8 kg CH₄ ha⁻¹; improved pasture: 1.5 kg CH₄ ha⁻¹ and soybean/ryegrass/corn: 0.3 kg CH₄ ha⁻¹). During the summer season, CH₄ emissions from the irrigated rice/fallow system (339.3 kg CH₄ ha⁻¹) were higher than the other systems (natural area: 3.2 kg CH₄ ha⁻¹; soybean/ryegrass/maize: 1.3 kg CH₄ ha⁻¹ and improved pasture: 0.8 kg CH₄ ha⁻¹). Irrigated rice/fallow system presents higher annual CH₄ emission than the other production systems mainly due to emissions associated with irrigated rice.

Keywords: greenhouse gas; mitigation; flooded rice; crop rotation; pasture

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