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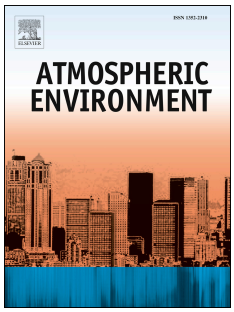

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1Assessing Environmental Impacts of Organic and Inorganic Fertilizer on Daily and Seasonal Greenhouse Gases Effluxes in Rice Field

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Abstract

According to the 5th Intergovernmental Panel on Climate Change evaluation report, the average surface temperature of the earth has escalated from 0.69 °C (1901) to 1.08 °C (2012), which is primarily ascribed to the anthropogenic emissions of Greenhouse Gases (GHGs). For the current study, a field experiment with four treatments, including chemical fertilizer, mixed fertilizer (MT), organic fertilizer (OT) and control (CK) was carried out in the Station of Long-term Fertilization Qingpu, Shanghai. The probable impact of fertilization on the average daily and accumulative emissions of GHGs were examined during different growth stages. The results indicated that fertilizer treatments considerably affected emissions of CH_4, N_2O and CO_2. CH_4 emitted most in OT, followed by MT, CT and CK, with the emissions of 77.29, 41.64, 30.20 and 17.37 kg·ha^{-1}, respectively. As for N_2O emissions, there were no significant variations between CT (1.18 kg·ha^{-1}) and MT (1.05 kg·ha^{-1}), which were both higher than OT (0.66 kg·ha^{-1}) and CK (0.23 kg·ha^{-1}). CO_2 emissions in CT (34371 kg·ha^{-1}) came first, followed by MT (28929 kg·ha^{-1}), OT (19118 kg·ha^{-1}) and CK (11533 kg·ha^{-1}), independently. Soil nutrients or fertility (humid acid, carbon, nitrogen, phosphorus, potassium and C: N) may perhaps speed up CH_4 emissions, whilst drainage implicated could alleviate its production. Furthermore, applying substantial organic fertilizer at once might accelerate sudden and huge release of N_2O. In addition, despite the inconsistencies among different years observed, the trend that organic fertilizer made the biggest amount of contribution to warming potential was alike. Consequently, the utilization of organic fertilizer should be mitigated, by applying some other inorganic fertilizers.

Keywords

Organic Fertilizer; Chemical Fertilizer; Rice; Greenhouse Gas; Seasonal Emissions; Environmental Factors

1. Introduction

The 5th Intergovernmental Panel on Climate Change evaluation report (IPCC, 2013) depicted that the global average surface temperature has risen by 0.39 °C (0.69-1.08 °C) between 1901 and 2012, and continuously leading to increased global warming (Farías *et al.*, 2015). Global warming is mostly attributed to the anthropogenic emissions of Greenhouse Gases (GHGs, such as CH_4, CO_2 and N_2O). The GHGs emissions from agricultural industries account for about 20% - 35% of the total global emissions, ranking second to energy. They are comprised of direct kinds of agricultural inputs (Thangarajan *et al.*, 2013; Zhao *et al.*, 2016). Nevertheless, the limited available field measurements contribute to high discrepancies in the approximations of GHGs emissions from the agricultural sector, such as a set of environmental factors that solidly rely on