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Carbon Dioxide (CO_2) and Methane (CH_4) Fluxes from Irrigated Wheat in a Subtropical Floodplain Soil Increased by Reduced Tillage, Residue Retention, and Nitrogen Application Rate

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Abstract : Quantifying carbon (C) sequestration in soils is necessary to help better understand the effect of agricultural practices on the C cycle. The estimated contribution of agricultural carbon dioxide (CO_2) and methane (CH_4) to global warming potential (GWP) has a wide range. The underlying causes of this huge uncertainty are the difficulties to predict the regional CO_2 and CH_4 loss due to the lack of experimental evidence on CO_2 and CH_4 emissions and associated drivers. The CH_4 and CO_2 emissions were measured in irrigated wheat in subtropical floodplain soils which have been under two soil disturbance levels (strip vs. conventional tillage; ST vs. CT being both with 30% residue retention) and three N fertilizer rates (60, 100, and 140% of the recommended N fertilizer dose, RD) in annual wheat (Triticum aestivum)-mungbean (Vigna radiata)-rice (Oryza sativa L) for seven consecutive years. The highest CH_4 and CO_2 emission peak was observed on day 3 after urea application in both tillages except CO_2 flux in CT. Nitrogen fertilizer application rate significantly influenced mean and cumulative CH_4 and CO_2 fluxes. The CH_4 and CO_2 fluxes decreased in an optimum dose of N fertilizer except for ST for CH_4. The CO_2 emission significantly showed higher emission at minimum (60% of RD) fertilizer application at both tillages. Soil microbial biomass carbon (MBC), organic carbon (SOC), Particulate organic carbon (POC), permanganate oxidisable carbon (POXC), basal respiration (BR) were significantly higher in ST which were negative and significantly correlated with CO_2. However, POC and POXC were positively and significantly correlated with CH_4 emission.

Keywords : carbon dioxide emissions, methane emission, nitrogen rate, tillage
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