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Residue Placement and Rate, Crop Species, and Nitrogen Fertilization Effects on Soil Greenhouse Gas Emissions

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ABSTRACT

High variability due to soil heterogeneity and climatic conditions challenge measurement of greenhouse gas (GHG) emissions as influenced by management practices in the field. To reduce this variability, we examined the effect of management practices on CO_2, N_2O, and CH_4 fluxes and soil temperature and water content from July to November, 2011 in a greenhouse. Treatments were incomplete combinations of residue placements (no residue, surface placement, and incorporation into the soil) and rates (0%, 0.25%, and 0.50%), crop species (spring wheat [*Triticum aestivum* L.], pea [*Pisum sativum* L.], and fallow), and N fertilization rates (0.11 and 0.96 g.N.pot^{-1}). Soil temperature was not influenced by treatments but water content was greater under fallow with surface residue than in other treatments. The GHG fluxes peaked immediately following water application and/or N fertilization, with coefficient of variation (CV) ranging from 21% to 46%, <50% of that reported in the field. Average CO_2 and N_2O fluxes across measurement dates were greater under wheat or fallow with surface residue and 0.96 g.N.pot^{-1} than in other treatments. Average CH_4 uptake was greater under fallow with surface or incorporated residue and 0.11 g.N.pot^{-1} than in other treatments. Doubling the residue rate increased CO_2 flux by 9%. Greater root respiration, N substrate availability, and soil water content increased CO_2 and N_2O emissions under wheat or fallow with surface residue and high N rate but fallow with low N rate increased CH_4 uptake. Controlled soil and environmental conditions substantially reduced variations in GHG fluxes.

KEYWORDS

Greenhouse Gases; Residue Management; Nitrogen Fertilization; Crop Species; Spatial Variability

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