（学位第３号様式）

学　位　論　文　要　旨

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題　目	Greenhouse gas emissions from agricultural activities –measuring and modeling N2O emissions– (農業活動からの温室効果ガス排出–N_2O 排出の測定及びモデリング–)

The greenhouse gas emissions from agricultural activities constitute a major problem that influences on global warming. Since significant proportion of greenhouse gases are either emitted during cultivation or during agricultural activities, describing characteristics of greenhouse gases is essential. Nitrous oxide (N_2O) is reported as one of the most powerful gases contributing to global warming effects. The characteristics of N_2O gas exposed to different climate conditions are however not clear-cut. This study investigated the emissions of N_2O gas and tested two computational models (DNDC and APSIM) for N_2O simulation.

Emissions of N_2O were measured from soil during exposure to different conditions of temperature and soil moisture (laboratory experiment). Additionally, for the experimental fieldwork, N_2O emissions from a sugarcane field were measured and correlated with data calculated by DNDC and APSIM models.

Conditions of temperature and soil moisture, resulting from using two chemical fertilizers, had significant influences on N_2O emissions. The trend of N_2O emissions was mainly associated with the water treatment applied within the experiment (from saturated conditions to drained conditions). Under conditions of high soil moisture over short periods, nitrification was the primarily source of N_2O emissions; and during prolonged saturated conditions nitrification was assumed as secondary source of N_2O. And similar conditions can be observed during rainfall events in upland fields. Regarding to the fertilizer use, our results suggest that by replacing types of nitrogen fertilizers does not necessarily result in a direct reduction of N_2O emissions.

When measuring N_2O in a sugarcane field, the fluxes were considerably larger in the daytime than in the night time, assuming they vary synchronously with the air temperature changes. Where nitrification was the main source of N_2O emissions and nitrifier denitrification occurred under high soil moisture conditions after rainfall. The simulations conducted using DNDC and APSIM showed specific point of divergence. The trend of N_2O emissions simulated by DNDC model was closely similar to that of the field data. I contrast; the N_2O emissions simulated by APSIM were smaller than field observation data. By comparing the characteristics of both DNDC and APSIM, focused in nitrification and denitrification (examined separately); the nitrification rate was larger than the denitrification rate in both models. However, in APSIM model, the nitrification rate was highest soon after the fertilization, whereas in DNDC, the nitrification rate occurred after rainfall events. This shows that the nitrification calculated by DNDC involves the effect of soil moisture, whereas that in APSIM model does not. Simulations of N_2O emissions associated with nitrification can be improved by modifying and validating more accurate coefficients within their equations.