Influences of Long-term Tillage and Drainage Systems on Greenhouse Gas Emissions from a Poorly-Drained Soil of Central Ohio

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INTRODUCTION

- Subsurface drainage of poorly-drained soils can improve aggregation, aeration and water retention, and hence may reduce greenhouse gas (GHG; CO_2, N_2O) fluxes.
- Objectives of this study were to assess the effects of tillage and drainage systems on GHG fluxes and soil organic carbon (SOC).

MATERIALS & METHODS

- The experimental layout was a factorial design comprising of two tillage and two drainage levels with three replications at the Ohio State University. Treatments were tile drained , undrained and no-till (NT), chisel till(CT)
- The GHG fluxes were monitored from the 12 plots in 2011 and 2012 seasons using Photoacoustic System (PAS), and SOC was measured by dry combustion method.

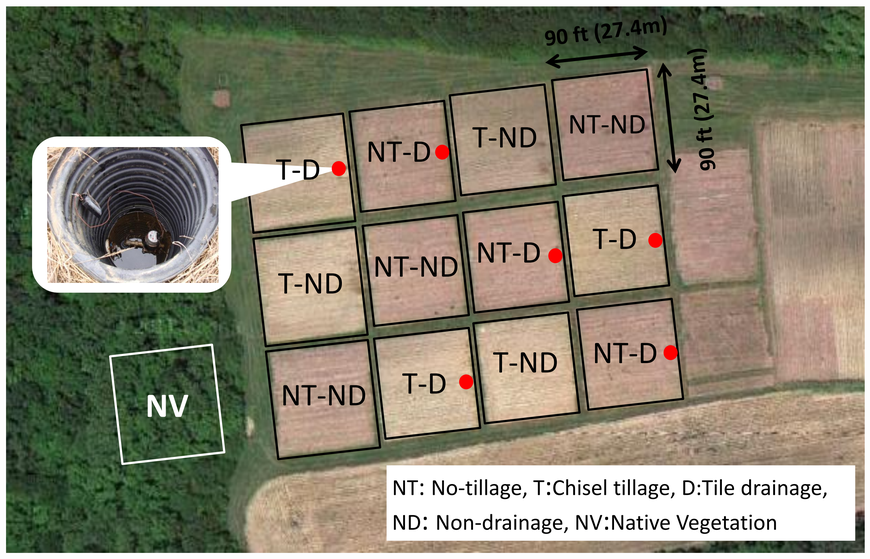

Fig. 1. Drainage plots at the Waterman Farm of The Ohio State University, Columbus, OH.

RESULTS & DISCUSSION

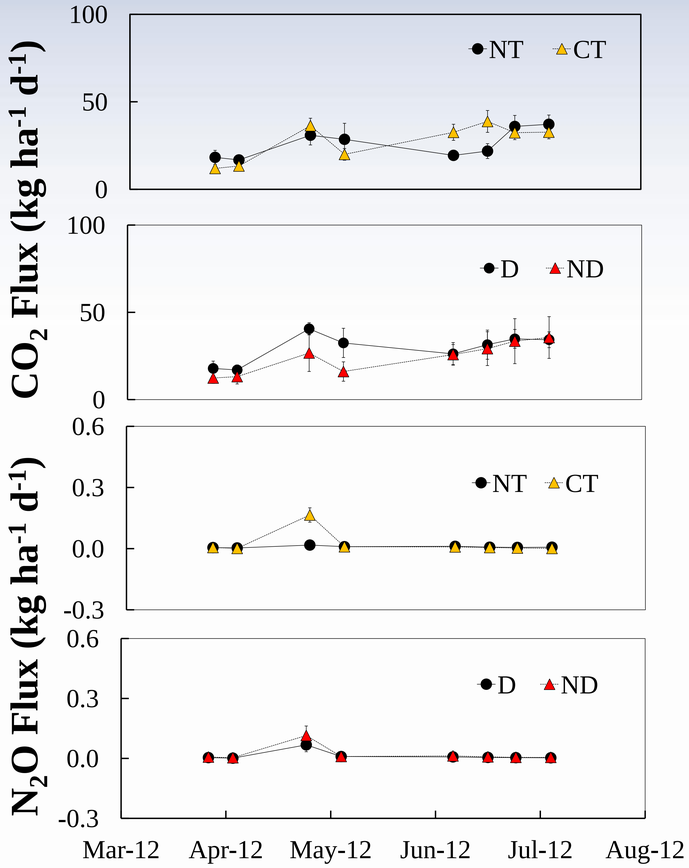

Fig. 2. GHG fluxes during April to July 2012

Table1. Tillage and drainage effects on SOC

Tillage	SOC (g kg^{-1})		
	0-10 cm	10 -20 cm	20-30 cm
No-till	19.6^{a}	16.8^{a}	11.7^{a}
Chisel till	15.2^{b}	11.5^{b}	9.8^{b}
Drainage	16.4^{a}	14.3^{a}	11.2^{a}
Non-drainage	18.4^{a}	14.0^{a}	10.2^{a}

- Results from this study show that SOC for the 0-10 cm depth under NT (19.6 g kg^{-1}) was 29% higher than that under CT (15.2 g kg^{-1}) soils.
- Tile drainage plots (16.4 g kg^{-1}) for 0-10 cm depth had 11% lower SOC than that under non-drainage (18.4 g kg^{-1}).
- Based on the average of March through July 2012, the CO_2 flux monitored from soils of CT (26.5 kg ha^{-1} d^{-1}) was 16% higher than those under NT (22.9 kg ha^{-1} d^{-1}).
- Similarly, the N_2O flux was 211% higher under CT (0.028 kg ha^{-1} d^{-1}) than those under NT(0.009 kg ha^{-1} d^{-1}).
- Tile drainage (0.014 kg ha^{-1} d^{-1}) improved soil aeration, and caused 39% less N_2O emissions compared with those of non-drainage(0.023 kg ha^{-1} d^{-1}).

CONCLUSION

- Long-term NT with subsurface drainage system improved soil aeration, and reduced GHG fluxes as compared to that of CT.

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