Cover crop and tillage systems effect on greenhouse gas emission at different topographic positions

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INTRODUCTION

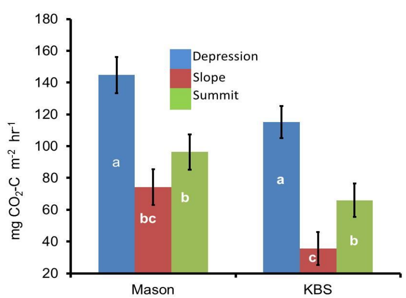
Intensive tillage systems decrease soil organic carbon (SOC) that hinder SOC sequestration potential of soils under conventional cropping system. Including cover crop to cropping system usually recommended to offset SOC lost during various agricultural practices. This is important because cover crop improves SOC sequestration by enhancing soil structure and adding organic matter to the soil. However; there is little information on the impact of cover crop and tillage systems on GHG emission at diverse terrain of agricultural landscapes. The objective of the study is to examine the effects of cover crop and tillage systems on carbon dioxide (CO_2) and nitrous oxide (N_2O) emission at different topographic positions.

MATERIALS AND METHODS

Location: Kellog Biological Station (KBS), and Mason, Michigan.
Treatments

- Two tillage systems (Chisel and ridge) as main plot, and with and without rye cover crop as subplot at three topographic position (depression, slope and summit).
- The study imitated at Kellogg Biological Station (KBS) and Mason in 2011.
- GHG (CO_2 and N_2O) was sampled with 1412 infrared Photoacoustic Spectroscopy (PAS)
- The GHG data were sampled from May 2012 to September 2012, mostly in weekly basis.
- SAS version 9.3 version was used the GHG data analysis.

RESULTS



Columns followed by different letters at each location indicate significant difference at P<0.05.
Fig. 1. Effect of topographic positions on CO_2-C emission in corn-soybean rotation system

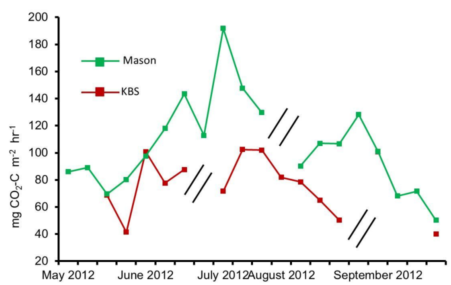
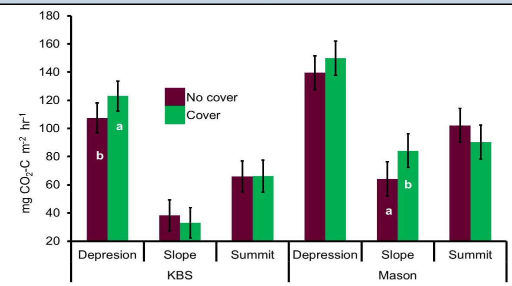


Fig. 2. Mean of carbon dioxide emission trends from May to September 2012.



Columns indicated by different letters are significantly different at P<0.10 for KBS, and P<0.05 for Mason.
Fig.3. Effects of cover crop on CO_2 emission at diverse topographic positions

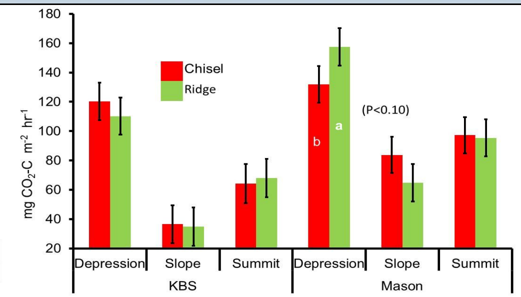
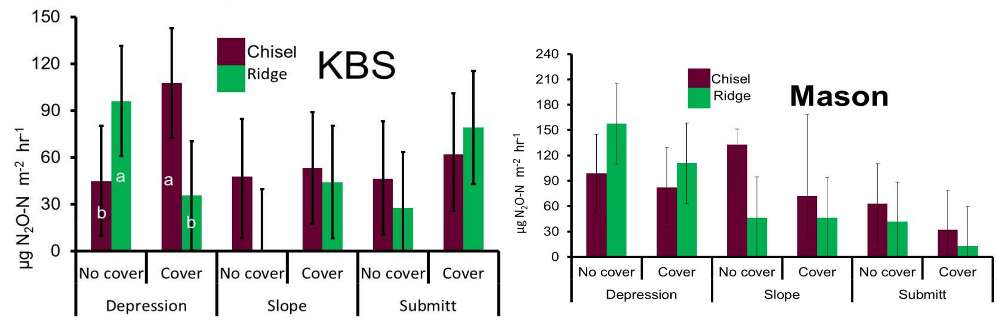


Fig. 4. Tillage systems effect on CO_2 emission at diverse topographic positions



Columns of the same color indicated by different letter at each topographic position are significantly different at P<0.05.
Fig. 5. Effects of cover crop and tillage systems on N_2O emission at diverse topographic positions.

CONCLUSIONS

- Depression emitted the highest concentration of CO_2-C both at KBS and Mason.
- Higher CO_2-C emission observed from June to July and then started to decline.
- The effects of cover crop and tillage systems on CO_2-C emission significantly higher at depression and slope (Fig. 3 and 4).
- Significant variation in N_2O-N emission observed at depression of KBS.
- Cover crop and tillage systems effects on GHG emission are different across diverse topographic positions and locations.

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