

Greenhouse Gases Emissions from a Corn and a Soybean Field in Relation to Soil Thermal Properties

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INTRODUCTION

The rise in atmospheric concentration of Greenhouse Gases (GHG's) has been a cause of concern for many industries including agriculture. Soil plays an important role as a source or sink of greenhouse gases in almost all terrestrial ecosystems (Li, 2007). However, many studies done on soil controlling factors for greenhouse gas emissions have focused mainly on how soil temperature effects the GHG's, while other soil thermal properties have received less attention (Dobbie and Smith,2003). The first objective of the study was to monitor the fluctuations of CO₂, CH₄, N₂O in a soybean and a corn field. The second objective was to determine if there was a relationship between the changes in soil thermal properties and greenhouse gas fluxes.

MATERIALS & METHODS

Study Area

The experiment was conducted at Lincoln University's Freeman Farm. The soil type was Waldron silty clay. The data was collected from June to November 2007.

Air Sampling and Gas Measurements

The chambers used were cylindrical polyvinylchloride that were 0.30 m long and 0.20 m in diameter. The chamber had two ventilation holes in the side that were covered during gas collection. The lid was made of Plexiglas and had two holes, one acted as a vent the other was covered and used for gas extraction. The lid was kept air tight by using high vacuum grease. During gas collection the chamber was left to fill with gases for 30 minutes. The gas was collected with a 50mL syringe and placed in a Tedlar bag. The samples were analyzed for CO₂, CH₄, N₂O within 2 hours of collection using the Shimadzu Greenhouse Gas GC-14 located at Lincoln University's Dickinson Research Laboratory.

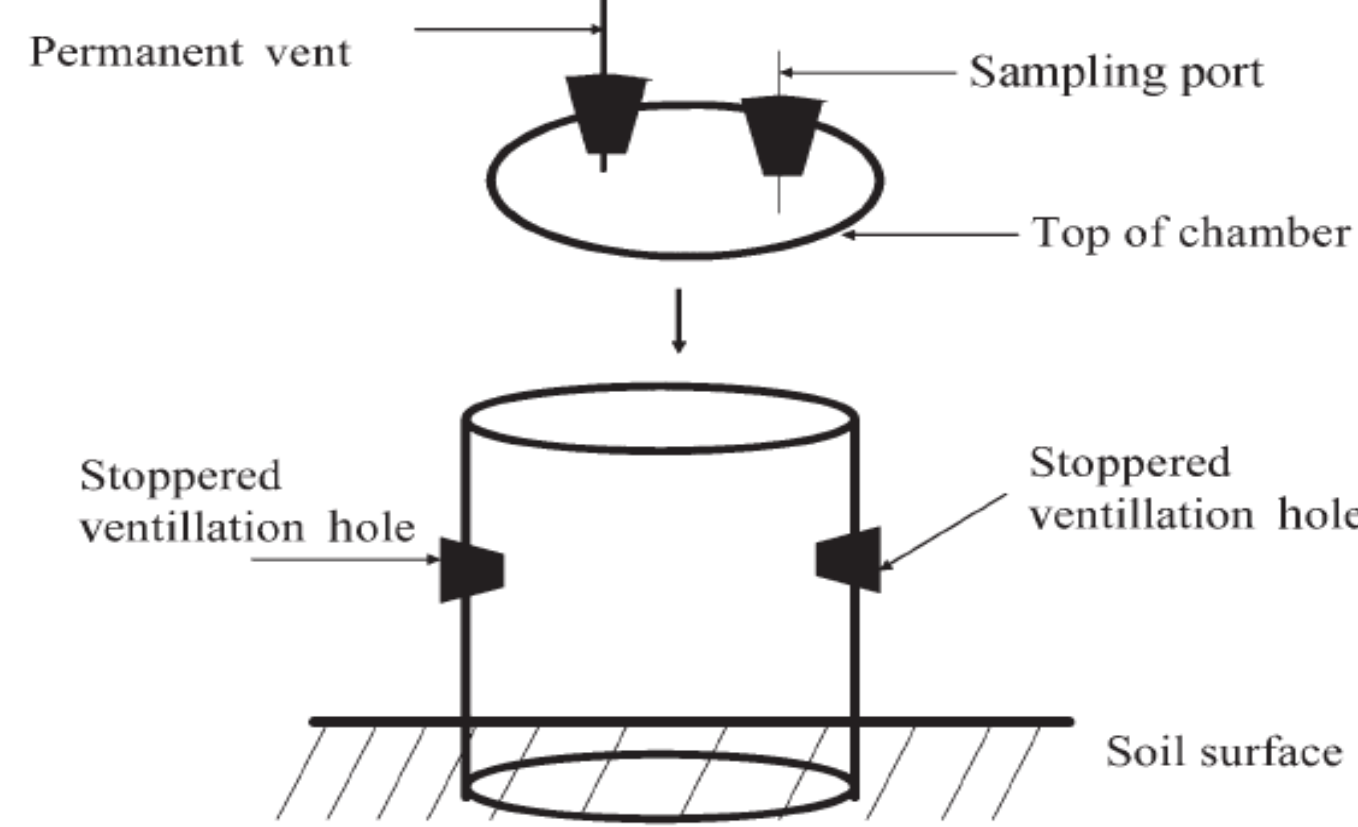
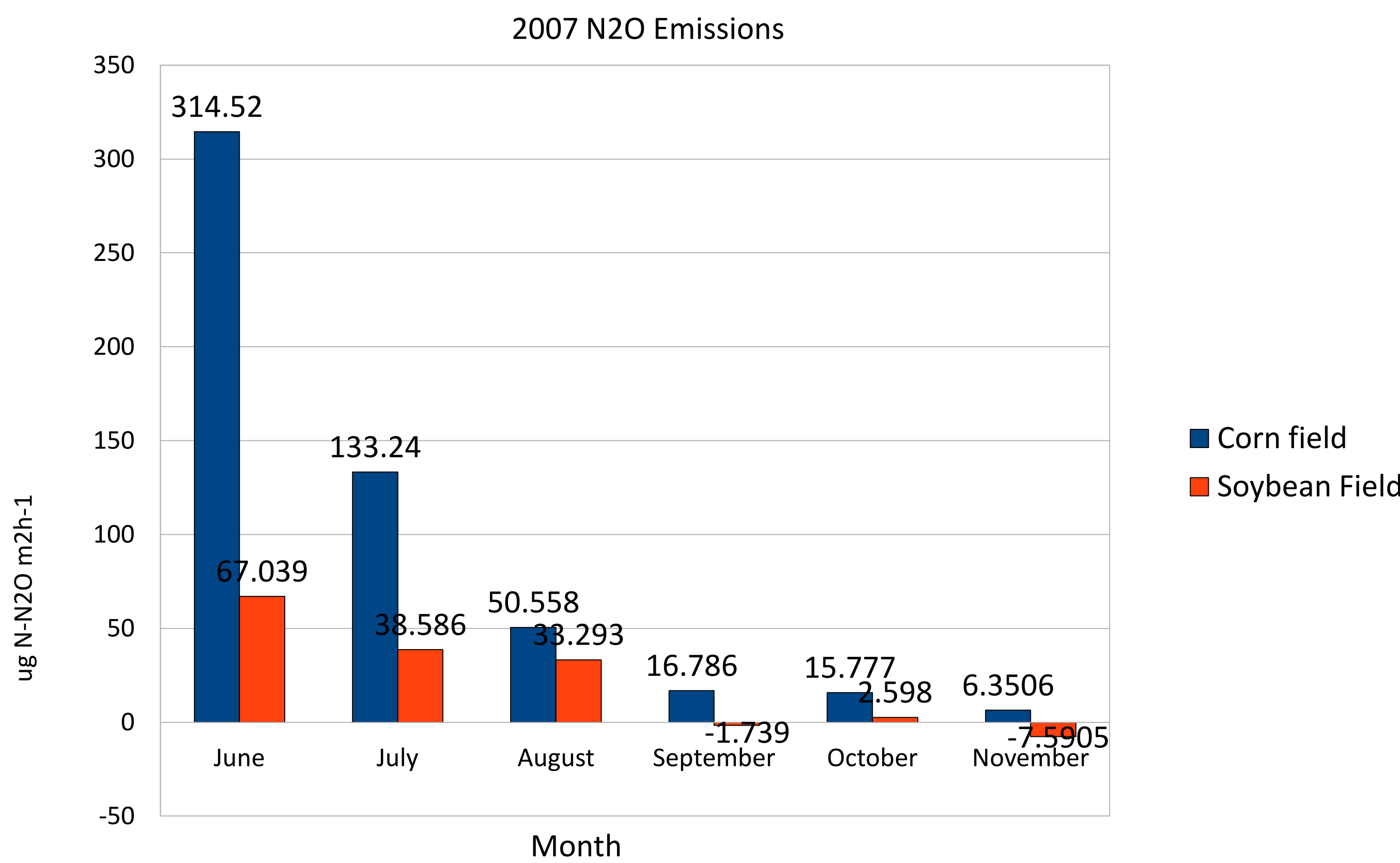
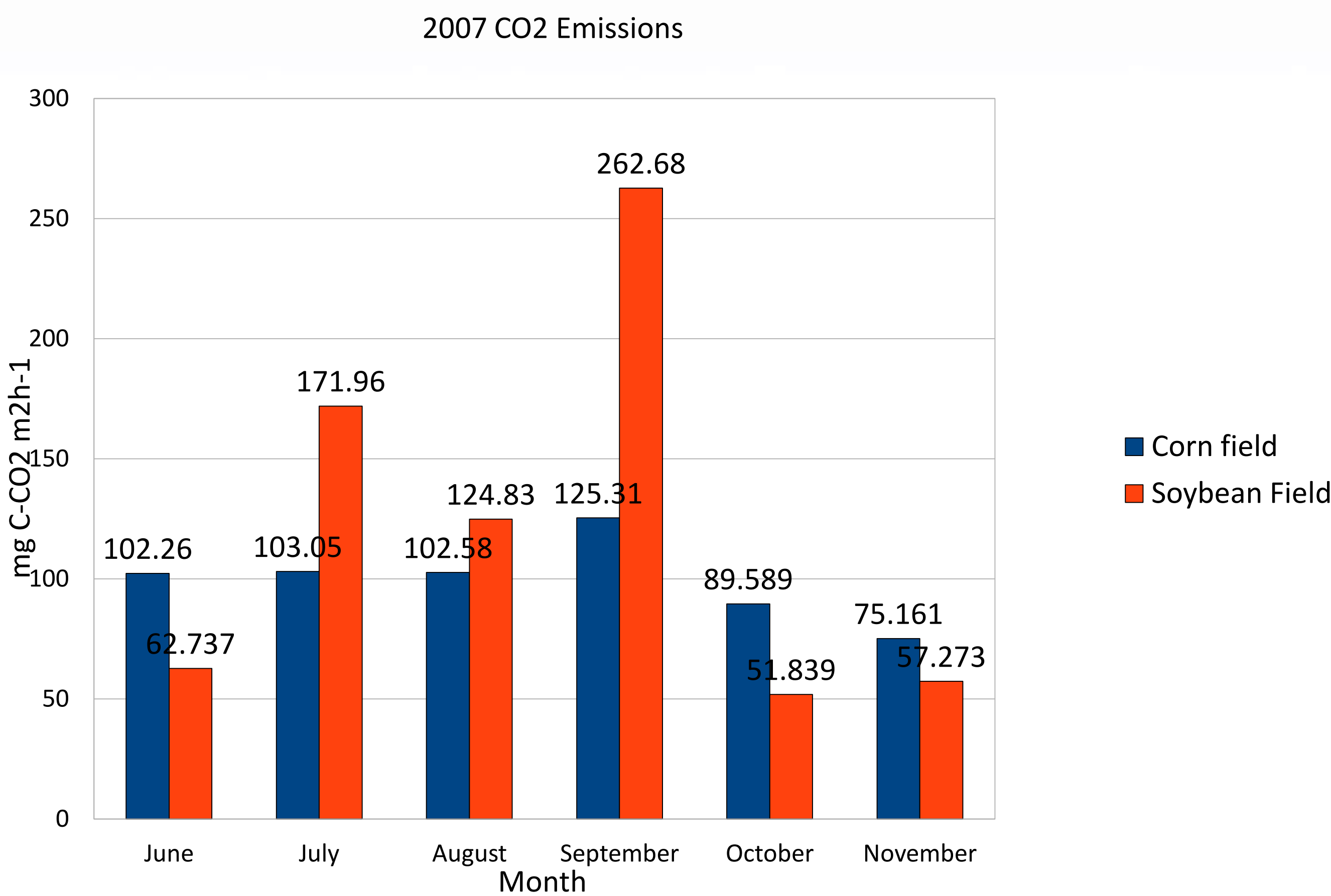
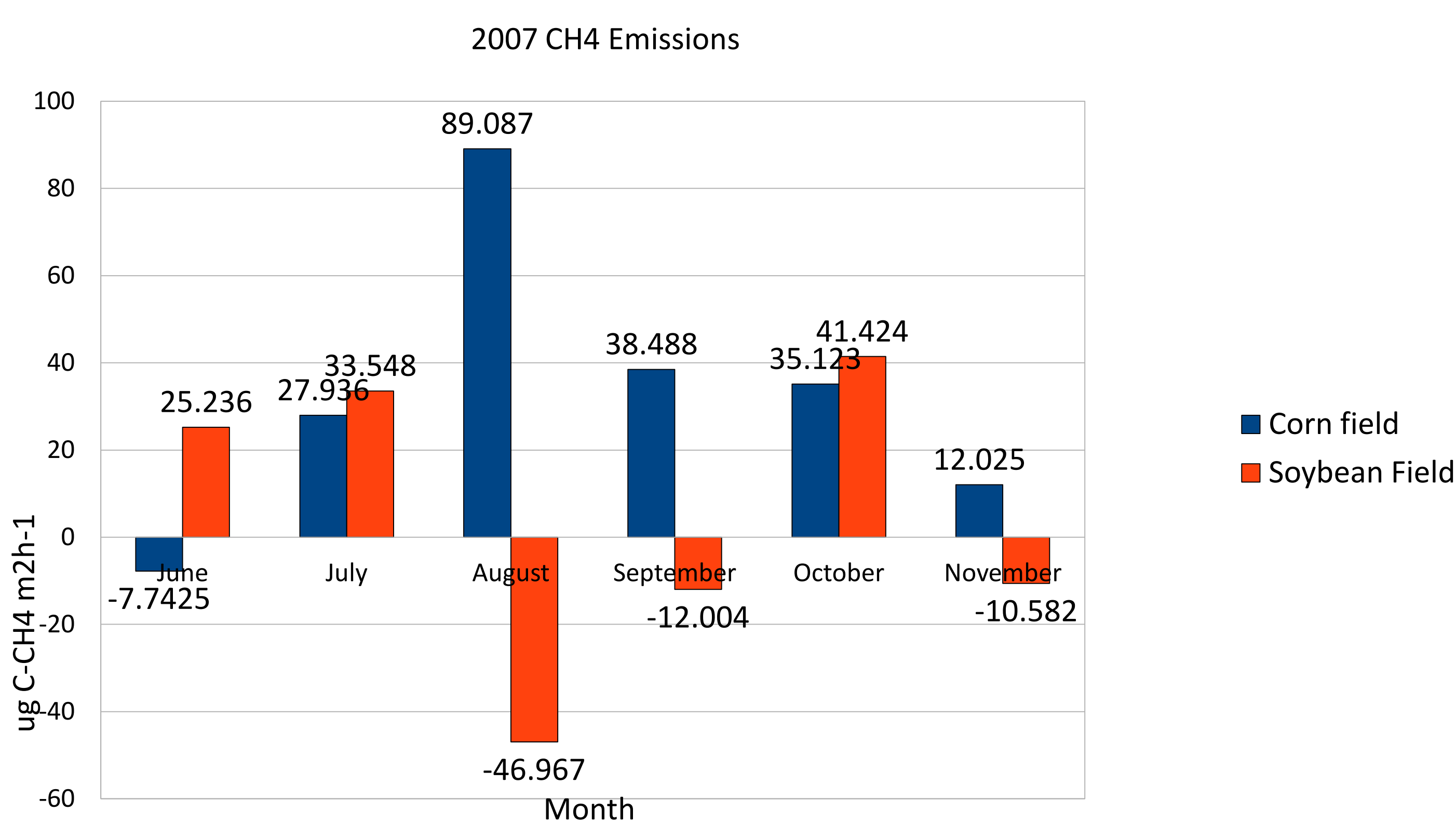


Fig. 2 Soil air sampling chamber.

Soil Thermal Properties

Soil temperature(T), Thermal diffusivity(D), thermal conductivity(K), specific heat(C), and thermal resistivity(R) were measured using a three sensor Decagon KD2 thermal meter at a 0.06 m depth.



CORRELATIONS

Corn 2007			p value	r value
	CO2	T	0.0000	0.5385
		K	0.0000	0.6083
		C	0.0000	0.6403
		R	0.0001	0.5385
	N2O	T	0.0001	0.5099
		CH4	0.0027	0.4359
		K	0.0022	0.4359
		C	0.0000	0.5568
		R	0.0300	0.3742

Soybean 2007			p value	r value
	CO2	T	0.0000	0.3967
		K	0.0061	0.2324
		R	0.0069	0.2287
		N2O	0.0010	0.3300

Corn 2007			p value	r value
June	CO2	T	0.0258	0.3561
July		K		
August		C		
September		R		
October	CH4	D	0.0468	0.3102
November	CO2	D	0.0234	0.3692

Soybean 2007			p value	r value
June	N2O	T	0.0148	0.4980
July		D		
August		CO2		
September		C		
October	CO2	T	0.0147	0.4987
November		D		
		C		
		N2O		

COEFFICIENT OF VARIATION

Soybean 2007		%
CO2		77.37
CH4		1318.4
N2O		176.18

Corn 2007		%
CO2		34.85
CH4		291.63
N2O		310.96

Discussion

Soil thermal properties did impact the fluxes of CO₂, CH₄, and N₂O, but the fluctuation of the relationships between soil thermal properties and fluxes show the need for more studies to be conducted.

LITERATURE CITED

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