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

Stephanie D. Sale and Nsalambi V. Nkongolo
Department of Agriculture and Environmental Sciences, Lincoln University, Missouri

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 CO_2, CH_4, N_2O 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 CO_2, CH_4, N_2O within 2 hours of collection using the Shimadzu Greenhouse Gas GC-14 located at Lincoln University's Dickinson Research Laboratory.

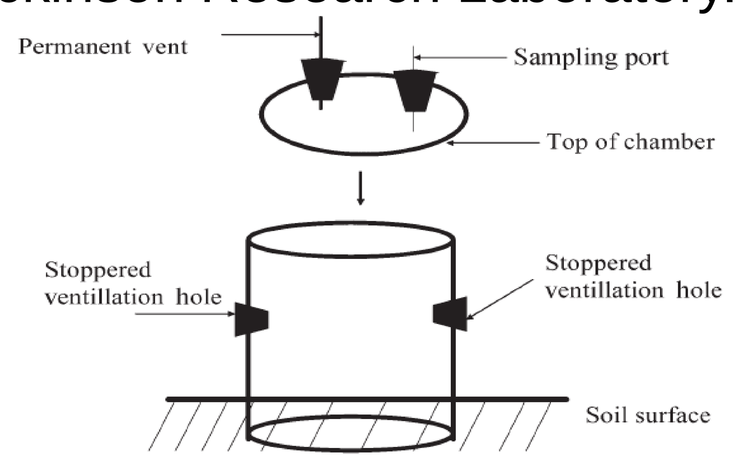
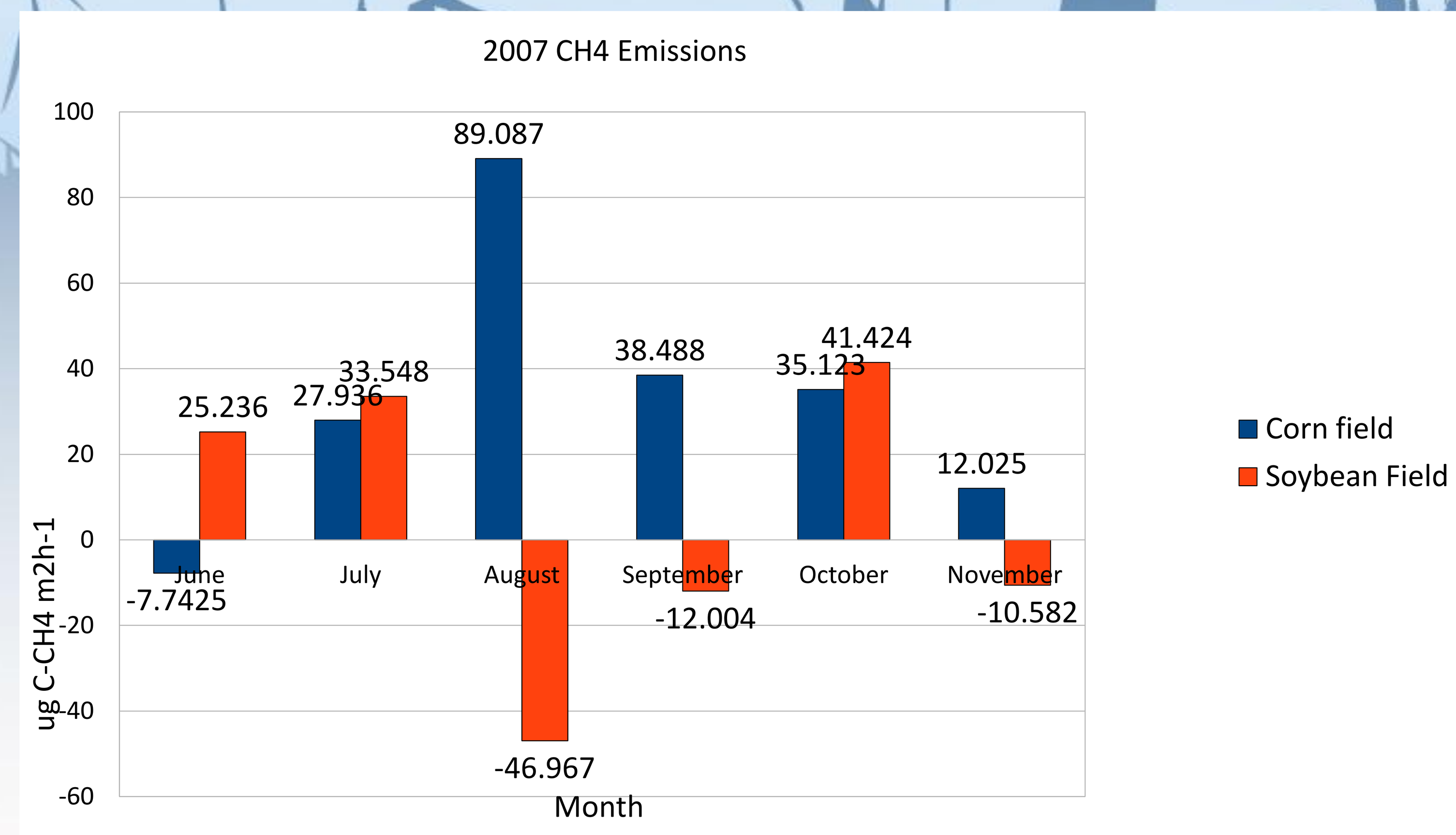
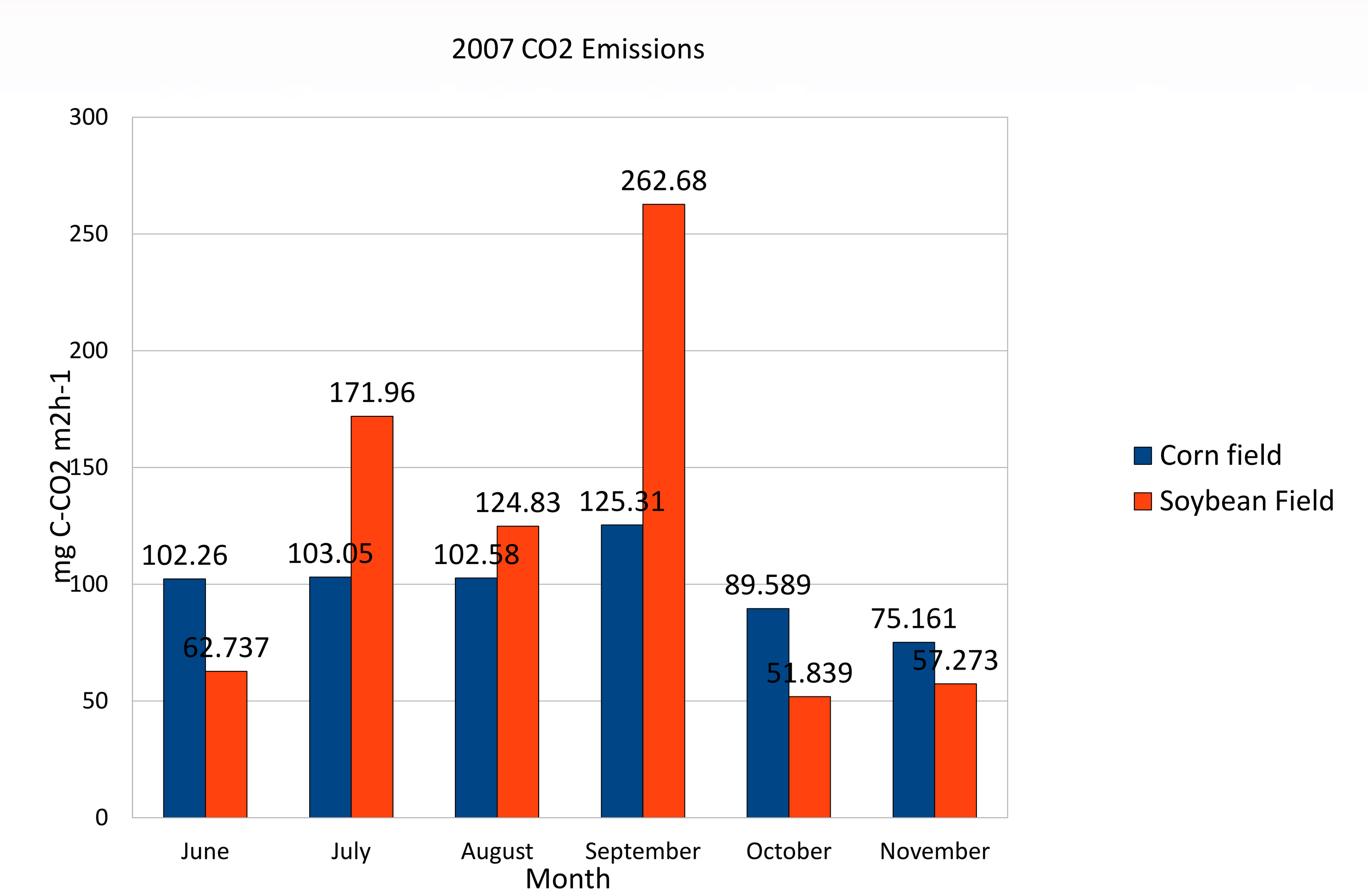


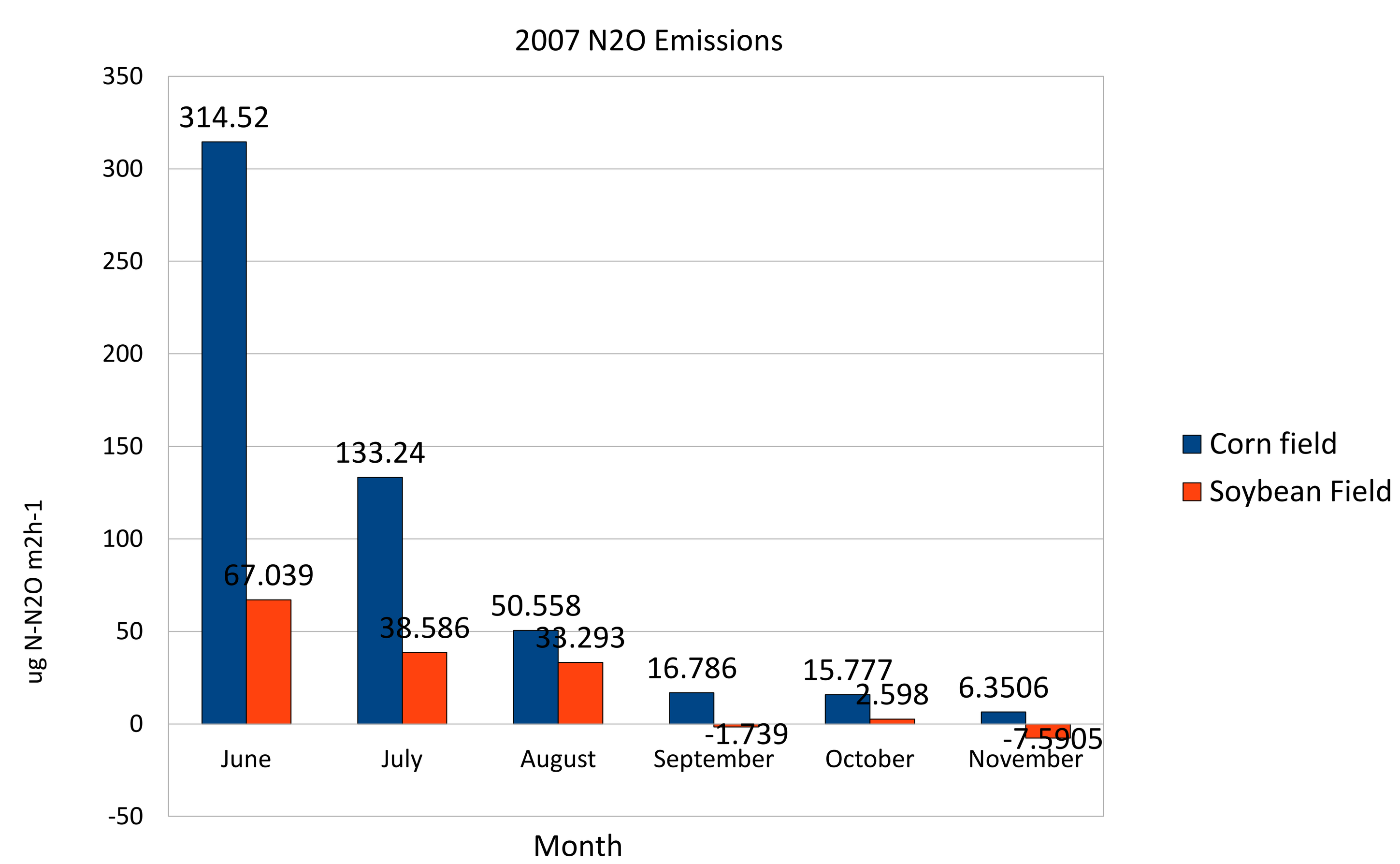
Fig. 2 Soil air sampling chamber.

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	T	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	C	0.0010	0.3300

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

Soybean 2007			p value	r value
June				
July	N2O	T	0.0148	0.4980
		D	0.0313	0.4358
August	CO2	D	0.0207	0.4715
		C	0.0460	0.3987
	N2O	C	0.0227	0.4638
September	CO2	T	0.0147	0.4987
October				
November				

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 CO_2, CH_4, and N_2O, 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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