Monitoring greenhouse gases emission and soil thermal properties in a corn and soybean field from 2004 to 2006

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INTRODUCTION

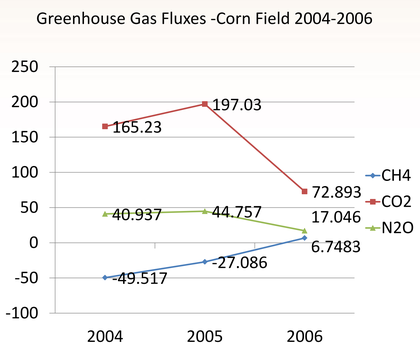
The rise in greenhouse gas emissions has been a cause of concern for many industries including agriculture. Soil properties and usage contribute to the rise in greenhouse gas emissions into the atmosphere. Understanding the relationship between soil properties and greenhouse gas emissions could help devise mitigation strategies. Many studies done on this topic focus mainly on how soil temperature effects the fluxes, while other 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 corn and soybean fields. A second objective was to determine if there was a relationship between the changes in soil thermal properties and greenhouse gas fluxes.

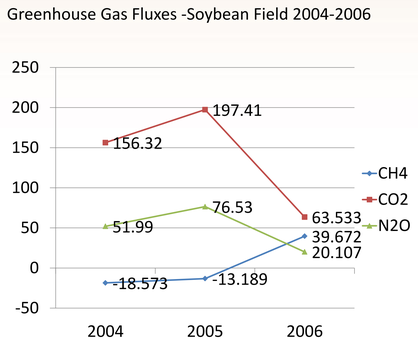
MATERIALS & METHODS

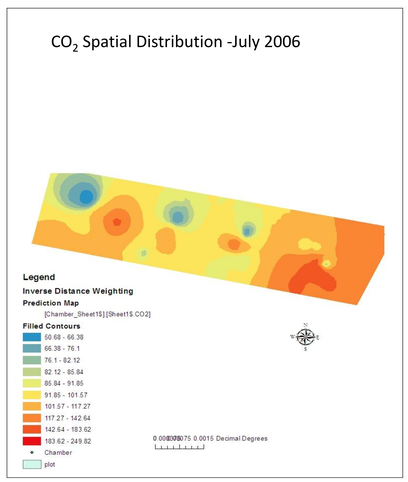
- *Study Area*
  - The experiment was conducted at Lincoln University's Freeman Farm. The corn field was located at 38°34'51.5532" N, 92°6'26.7474" W. The soybean field was located at 38°34'54.66"N, 92°6'26.082"W. The main soil types of these fields are Grable very fine sandy loam and Waldron silty clay. The data was collected from 2004-2009. The data from 2004-2006 was analyzed and is discussed.
- *Air Sampling and Gas Measurements*
  - The chambers used were cylindrical polyvinylchloride that were 0.30 m long and 0.20 m in diameter. Each 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 Chromatograph CH -14 located a Lincoln University's Dickinson Research Laboratory.
- Soil Thermal Properties
  - Soil temperature(T), Thermal diffusivity(D), thermal conductivity(K), and thermal resistivity(R) were measured using a three-sensor Decagon KD2 thermal meter at a 0.06 m depth.

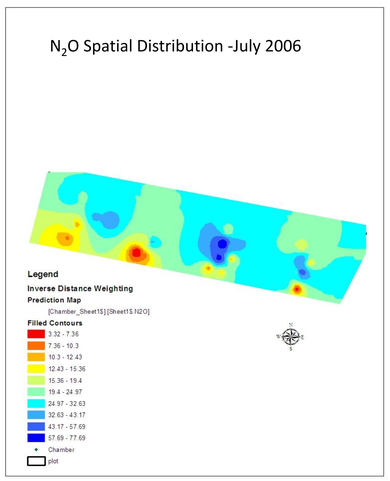
RESULTS

Statistical analysis of the data for greenhouse gas fluxes and soil thermal properties were conducted using Statistix 9. ArcMap was used to create maps showing the spatial distribution of CO_2 and N_2O from the corn field in July of 2006.









DISCUSSION

Results show a fluctuation of gas emissions from 2004 to 2006. In both soybean and corn fields, there is a rise in CO_2 and N_2O emissions from 2004 to 2005 but a significant drop in 2006. The opposite can be seen with CH_4 where the field acted as a sink in 2004 and 2005, but became a source in 2006. The correlations (based on yearly data) show that in soybean fields, T significantly correlated with CO_2 and CH_4 emissions in both 2004 and 2005 but T did not correlate with any of the gases in 2006. In 2005, there was also a correlation between K and T with N_2O emissions. In 2006 the only correlation was between CO_2 emissions and R and K. In the corn fields, R and K correlated with N_2O emissions for all three years. D and T also correlated with N_2O in 2004. T correlated with CH_4 in 2004 and 2006.

CONCLUSION

The data varies greatly from year to year and even greater when it is analyzed from month to month. The data also shows that soil thermal properties do impact the emission of CO_2, CH_4, and N_2O, but the fluctuation of the relationship stresses the need for more studies.

REFERENCES

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