

Comparison between Gas Chromatograph (GC) and Photo Acoustic (PAS) Methods for Measuring CO₂ and N₂O Emissions in Corn-Soybean Field

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INTRODUCTION

Rapid, precise and comparable methods for monitoring greenhouse gases (GHGs) fluxes are needed for climate change studies. Gas chromatography (GC) is widely used in these studies but it is manual and time consuming. Photo Acoustic Gas Analyzer (PAS) is a new option for accurate, in-situ and rapid measurement of GHGs, but results need to be compared with other methods (Tirol-Padre et al.2014).

OBJECTIVE

To compare values of CO₂ and N₂O emissions obtained by both GC and PAS.

MATERIAL AND METHODS

The study was conducted in 2012 and 2013 on a Waldron silt loam soil at Freeman Farm of Lincoln University.

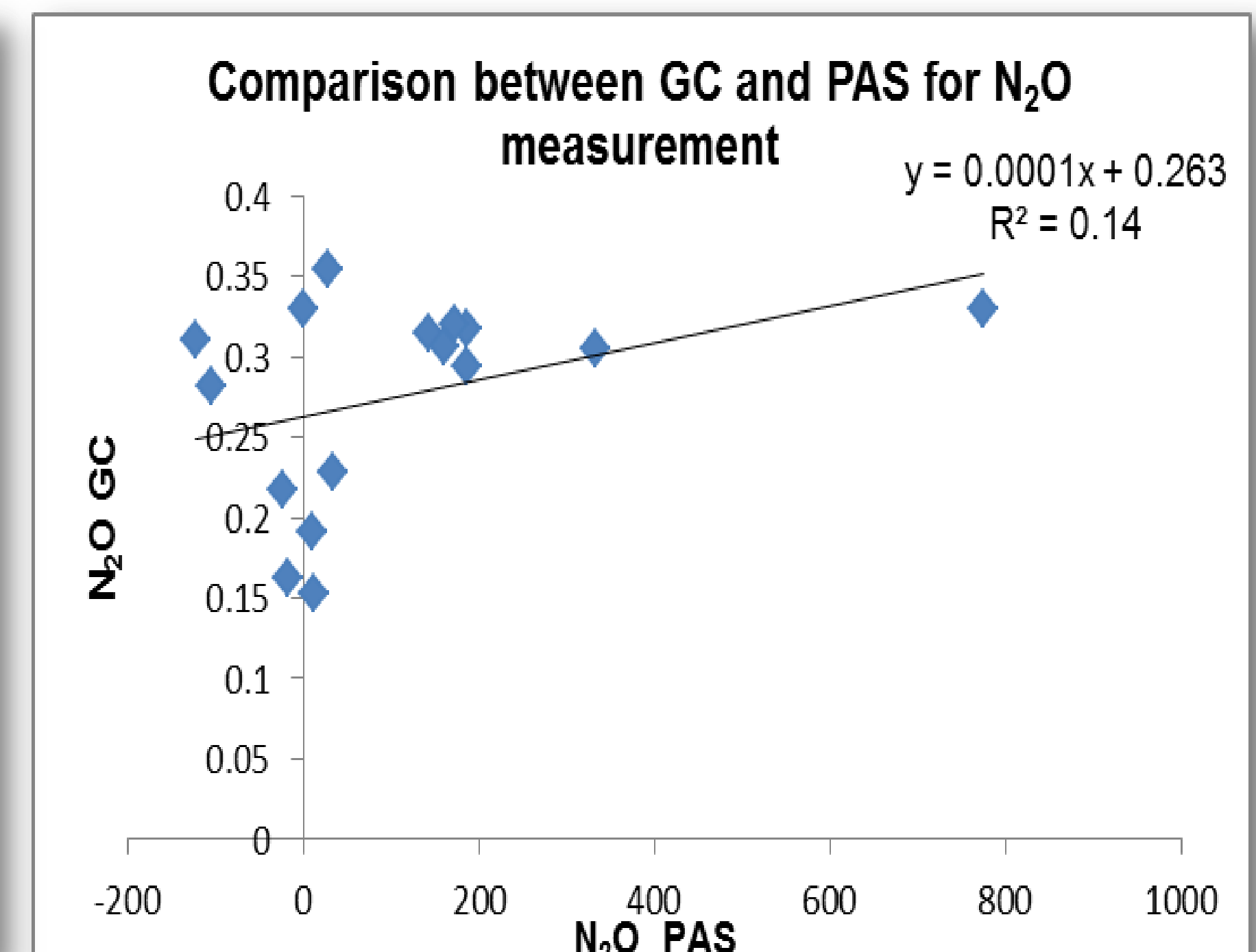
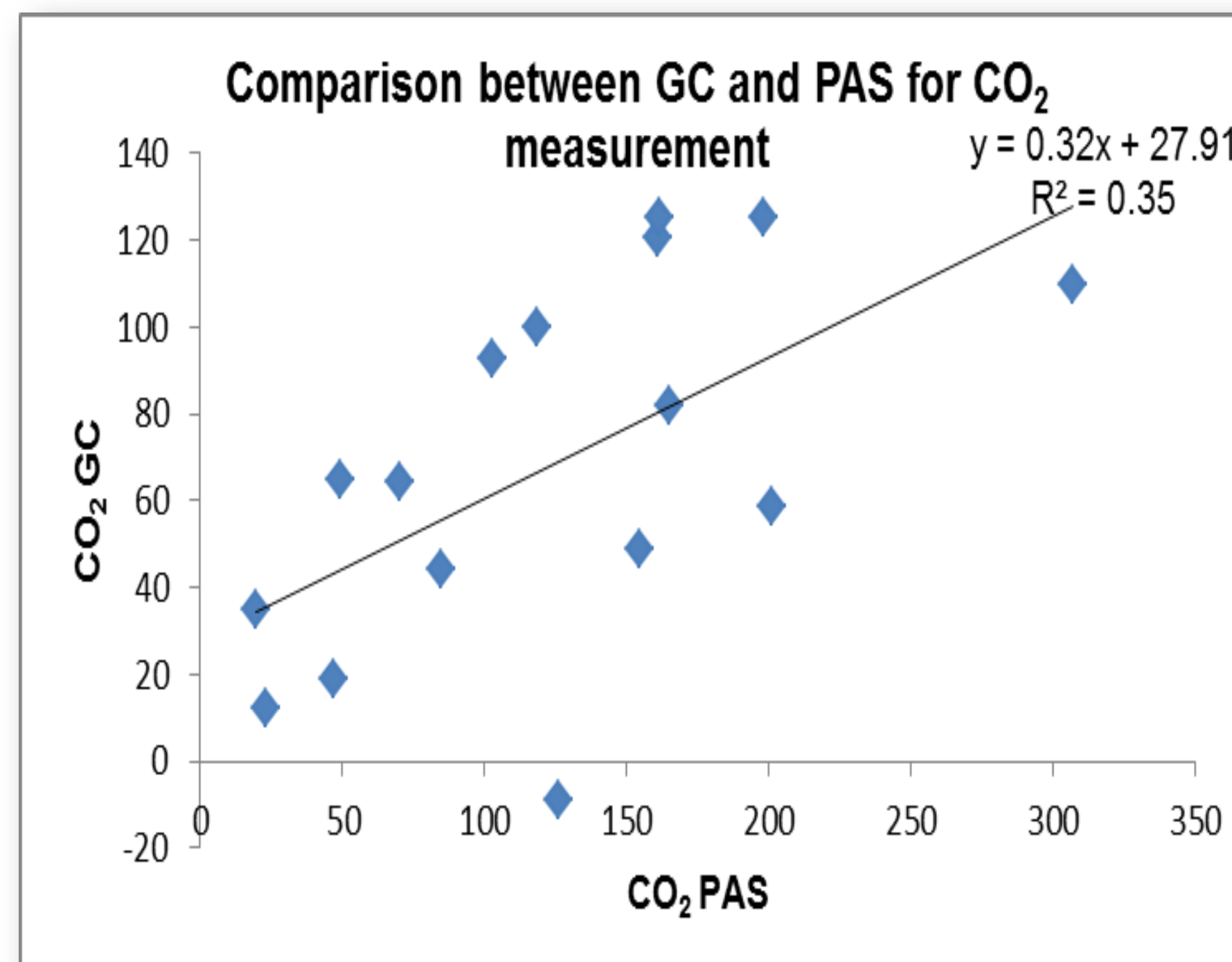
48 cylindrical polyvinylchloride static and closed chambers measuring 0.30 m in height and 0.20 m in diameter were permanently inserted into the soil to a depth of approximately 0.05 m in 4.05 ha corn and soybean field.

Soil air samples for gas analysis were collected at 16 locations. Analysis for soil air samples for determination of the concentrations of CO₂ and N₂O was conducted using GC at Dickinson Center as PAS directly measured the concentrations at these 16 locations.

RESULTS AND DISCUSSION

Summary of Descriptive Statistics

	N ₂ O PAS 2012 (µg N-N ₂ O/m ² h)	N ₂ O GC 2012 (µg N-N ₂ O/m ² h)	CO ₂ PAS 2013 (mg C-CO ₂ /m ² h)	CO ₂ GC 2013 (mg C-CO ₂ /m ² h)
Mean	110.39	0.27	124.26	68.39
SD	214.62	0.06	76.56	42.06
C.V.	194.42	23.21	61.61	61.49
Minimum	-123.33	0.15	19.40	-9.0
Median	30.83	0.30	122.11	64.55
Maximum	775	0.35	306.9	125.48
Skew	1.91	-0.82	0.59	-0.17
Kurtosis	3.83	-0.75	0.08	-1.03



Results showed that on the month of June, 2013 PAS values of CO₂ showed a significant relationship ($r= 0.59$, $p< 0.05$) with GC measurements. In addition, on the month of June, 2012 PAS values of N₂O also showed a moderate relationship ($r= 0.38$, $p< 0.05$) with GC measurements.

CONCLUSION

The results showed the significant relationship between the values obtained by both GC and PAS for CO₂ emissions. Whereas for N₂O emissions, no significant results were found. The discrepancy between PAS and GC measurements for soil gas fluxes is not clear yet and further studies are needed.

RECOMMENDATIONS

The study is continuing and will yield more results in order to conclude the best suitable method for accurate CO₂ and N₂O emissions measurements.

REFERENCES

Tirol-Padre, A., Rai, M., Gathala, M., Sharma, S., Kumar, V., Sharma, P.C., Sharma, D.K., Wassmann, R., Ladha, J. 2014. Assessing the performance of the photo acoustic infrared gas monitor for measuring CO₂, N₂O and CH₄ fluxes in two major cereal rotations. *Global Change Biology*. 20:287-299.