N_2O and CO_2 flux measurements by photoacoustic infrared spectroscopy

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INTRODUCTION

Several micrometeorological techniques and chamber methods are being used to measure greenhouse gas fluxes. However, these systems operate under certain limited conditions and require substantial logistical and technical resources that limit their implementation (Smith et al., 1994; Christensen et al., 1996). Recently, PAS has been used with chamber technique for flux measurements of two to five gases simultaneously. However, limited information is available on the use of PAS in estimating greenhouse gases in the field.

OBJECTIVES

- To check consistency and accuracy of N_2O and CO_2 gas flux measurements of six photoacoustic infrared spectroscopy (PAS).
- To compare PAS measurements of N_2O and CO_2 emissions with gas chromatography (GC).

MATERIALS

RESULTS

Table 1. Means of NIST standard N_2O (0.7148 PPM) and CO_2 (473.45 PPM) run through six PAS at 2 min interval during 30 min.

	N_2O		CO_2	
	Run (PPM)	Deviation from standard	Run (PPM)	Deviation from standard
PAS 1	0.719	-0.006	514.70	-0.040
PAS 2	0.679	0.049	493.53	-0.040
PAS 3	0.668	0.065	493.33	-0.080
PAS 4	0.675	0.055	488.84	-0.031
PAS 5	0.711	0.005	527.05	-0.101
PAS 6	0.651	0.088	518.26	-0.086

Fig 1. Comparison of N_2O flux measurements between PAS and GC. Six PAS were connected to one soil chamber, and samples were manually drawn for GC analysis.

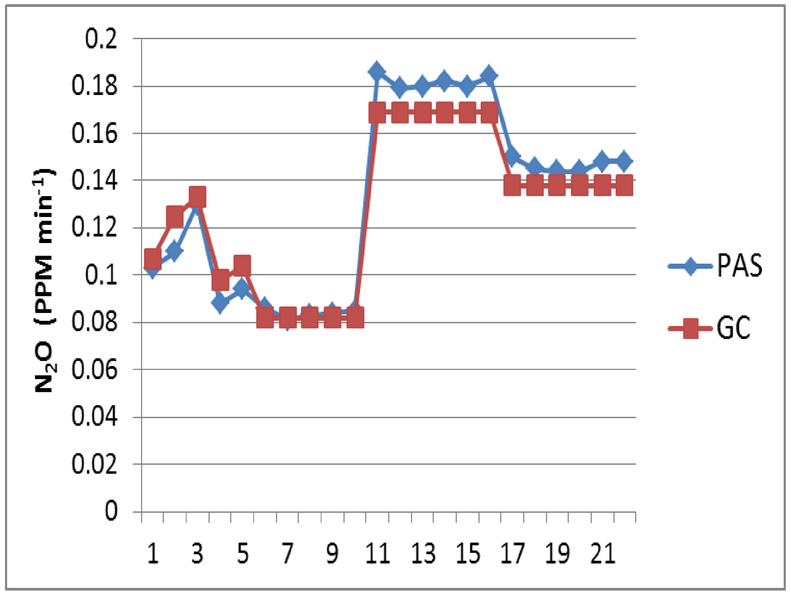
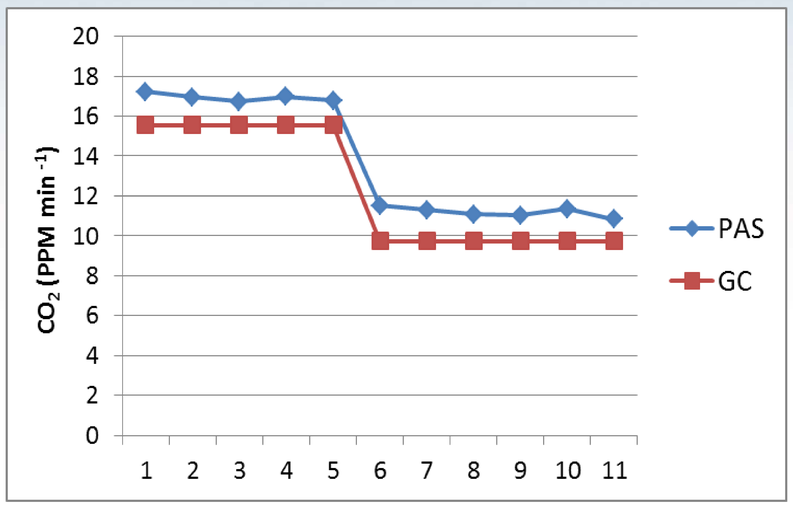


Fig 2. Comparison of CO_2 flux measurements between PAS and GC. Six PAS were connected to one soil chamber, and samples were manually drawn for GC analysis.



CONCLUSION

- ❑ GC and PAS can both measure NIST-certified gas standards within 5% of the real value.
- ❑ Because the precision of nitrous oxide and carbon dioxide measurements with GC is typically 5%, these two analytical techniques produce measurements of nitrous oxide and carbon dioxide with similar accuracy

REFERENCES

Christensen et al., 1996. Nitrous oxide emission from an agricultural field: Comparison between measurements by flux chamber and micrometeorological techniques. Atmospheric Environment 30, 4183-4190.

Smith et al., 1994. Micrometeorological and chamber methods for measurements of nitrous oxide fluxes between soils and the atmosphere: Overview and conclusions. Journal of Geophysical research 99, 541-548.

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