Continuous Automated Measurements of Soil N_2O and CO_2 Emissions with the Portable IRGA System in the Static Chamber Microplot Study

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INTRODUCTION

An accurate assessment of diurnal, event-driven, and seasonal dynamics in soil greenhouse gas emissions is required for predicting the effects of agricultural management practices on global climate change. Portable IRGA Li-Cor 8100A CO_2 analyzer offers such monitoring solution with the capability of utilizing additional continuous flow analyzers for measuring N_2O.

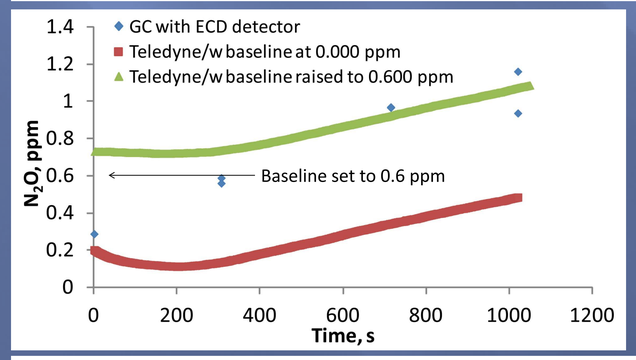
MATERIALS AND METHODS

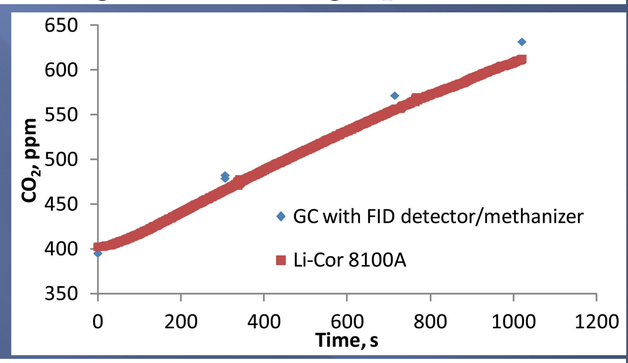
We implemented a combination of the Li-Cor 8100A and Teledyne T320 infrared gas analyzer (IRGA) portable system to measure the CO_2 and N_2O fluxes from soil in the microplot experiment with contrasting N application rates in a wheat site

The Teledyne T320 N_2O analyzer (0-1000ppm N_2O range) was placed in line with the Li-Cor 8100A gas analyzer and Li-Cor 8150A Multiplexer via the ¼" Bev-A-Line tubing connections. Auxiliary sensor interface on one of the Long-Term Chambers 8100-104 was utilized for the concurrent N_2O data recording from the Teledyne T320 by Li-8100 software through the analog data cable. Due to differences in the flow rate of the Teledyne T320 (0.8 L min^{-1}) and the air flow output by Li-Cor 8100A (1.7 L min^{-1}) a bypass tubing was added to divert excess flow into the incubation chamber. The total of 4 Li-Cor 8100 (16 chambers each) and 4 Teledyne T320 were set up on site.

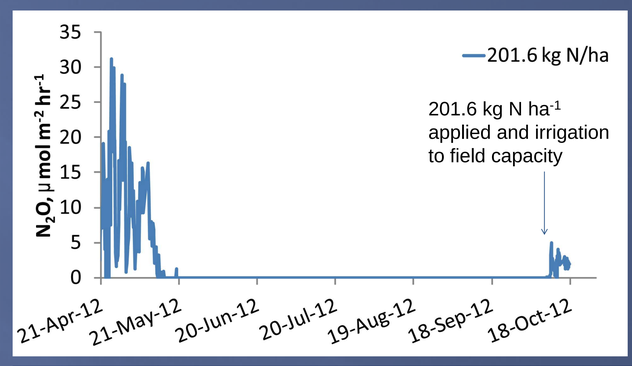
RESULTS AND DISCUSSION

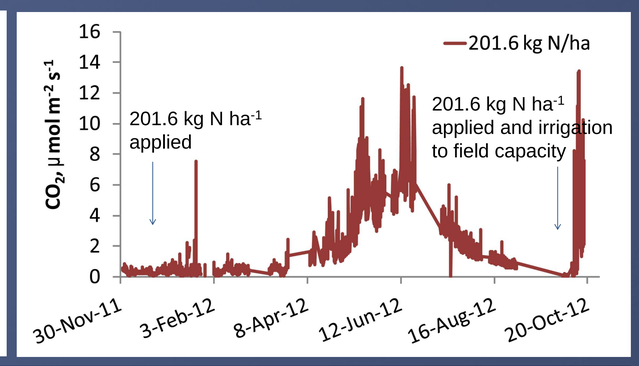
The setup was tested for accuracy on the gas chromatograph.



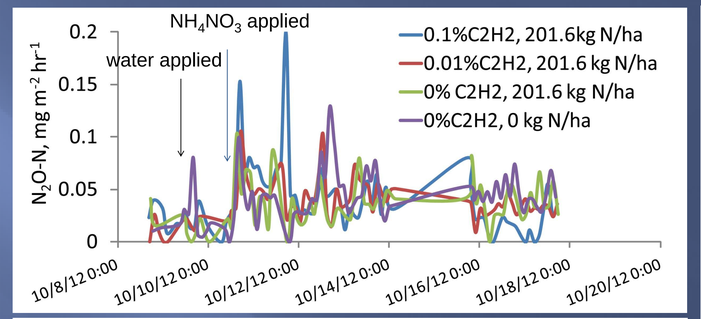


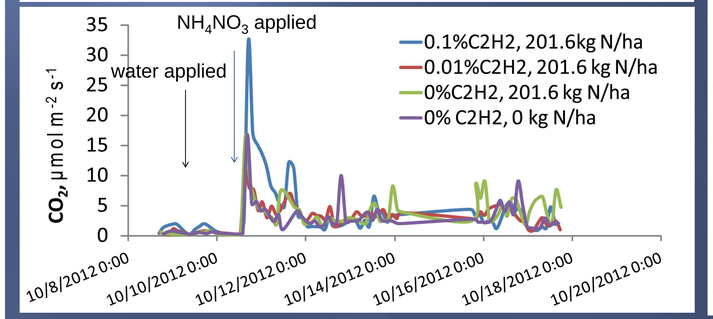
The baseline on the Teledyne T320 drifted down due to change in air humidity for the first 300 s of measurement, and was adjusted by raising it to 0.6 ppm. The CO_2 readings were accurate.



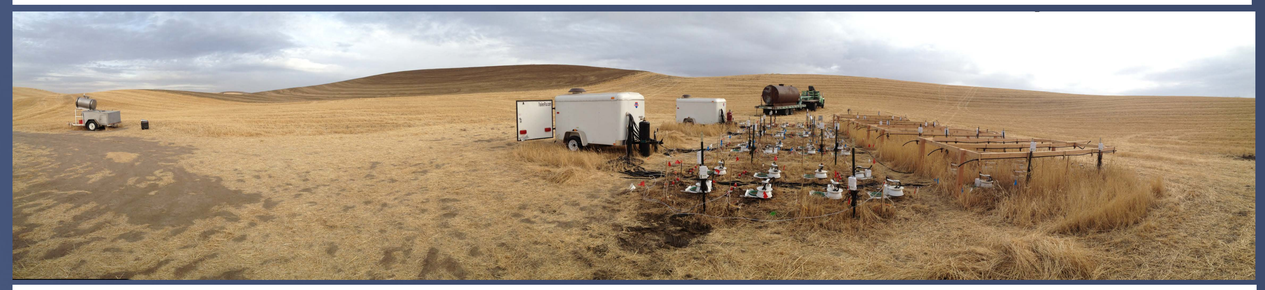


Measurements were conducted 24/7/365. The flush of N_2O was observed in the spring, and also in the fall immediately following the irrigation and N fertilization experiment. CO_2 peaked out during May-June period prior to drought, and immediately after initial wetting.





Peaks of N_2O concentrations were detected during the fertilizer application event. Acetylene treatment resulted in highest peaks during that period, likely due to C_2H_2 block of N_2O reduction to N_2 in the saturated conditions. The highest levels of CO_2 were reached in the C_2H_2 treatments, likely due to increased microbial activity. Both CO_2 and N_2O peaks lasted for approximately 24 hours, indicating importance of continuous measurements for accurate detection.



CONCLUSIONS

- **Teledyne T320 IRGA N_2O analyzer placed in line with Li-Cor 8100A results in a powerful setup capable of detecting short-term events.**
- **Extended incubation times (17 min) are necessary to detect N_2O emissions from the agronomic fertilizer N applications.**

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