

Introduction: A twelve chamber, temperature controlled, photosynthesis system using a custom PC based data acquisition system, was adapted for use in the field using custom temperature controllers to track ambient temperature. This system measured photosynthesis and respiration continuously from stems and leaves, using replicate chambers for clones within a treatment ring to provide a daily carbon budget for above ground plant tissue. The open system makes 30-60 integrated measurements per hour, and has been modified to provide elevated CO₂ control to simulate ring conditions in CO₂ treatments.

Diurnal Measurements of Carbon Assimilation and Respiration of Leaves and Stems Using an Automated Multiple Chamber System

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Fig. 4. PC based data Acquisition system to measure and monitor physiological and environmental parameters for the 12 chamber system.

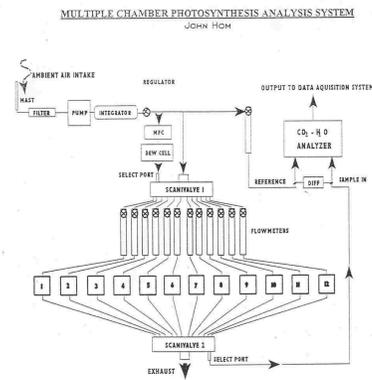


Fig. 5. Basic Flow diagram of the gas handling system showing constant flow through the open system, scanivalve and mass flowmeter control of measurement stream.

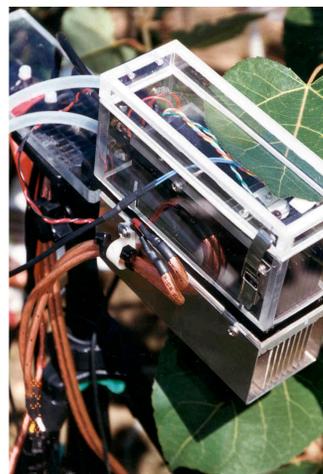


Fig. 1, 2, 3. Field portable gas analysis system for 12 chambers with mass flowmeter control of sample gas, elevated CO₂ mixing.

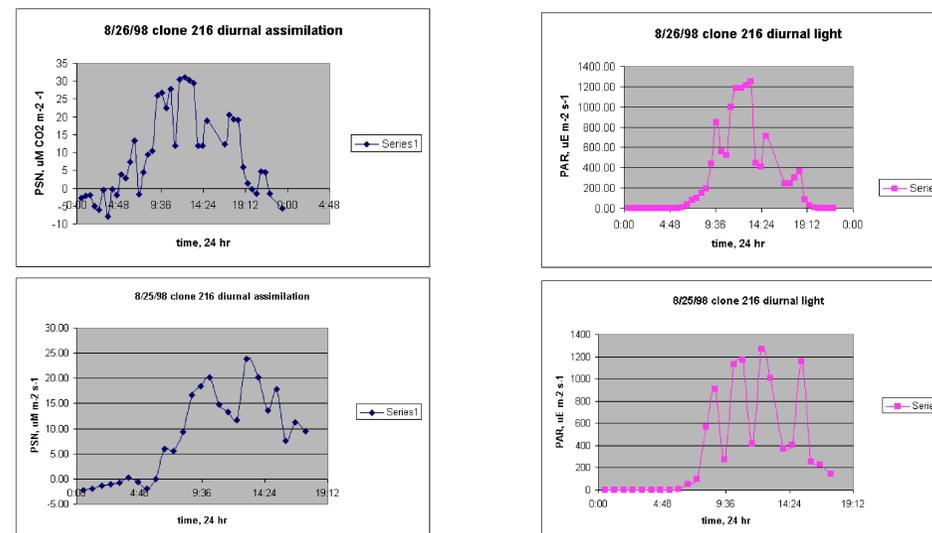


Fig. 6. Results of diurnal course of carbon uptake and respiration showing influence of changing light conditions.

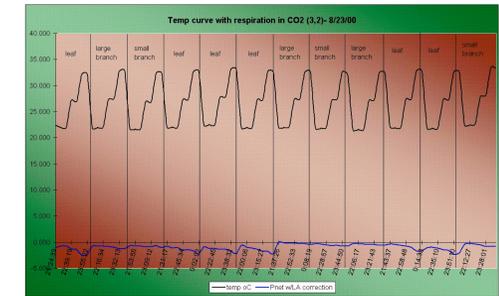
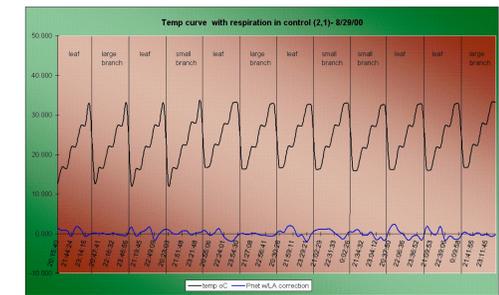


Fig. 7,8. Dark respiration rates under different temperatures for control and elevated CO₂ treatments.

Summary: An automated, temperature and CO₂ controlled, multiple cuvette photo synthetic system was adapted to measure daily carbon sums for leaves and stems within a treatment ring. The goal is to generate daily totals of carbon assimilation and respirations for leaves and small stems to contribute to the carbon budget of aspen under different treatments. The system has been adapted to track ambient temperature conditions and to provide elevated CO₂ levels to chambers to work in all treatment rings. The ability to do continuous photosynthesis and respirations measurements, with replication, under existing conditions, will contribute to the suite of physiological parameters that are being measured at the Rhineland FACE site. Respiration under different temperature regimes will contribute to parameterizing models.

Continuous improvements to the system will include: greater portability, scaffolding for canopy access, solving for high CO₂ diffusion gradients with better sealing material, decreasing the flow resistance of long sample lines, and inherent zero drift with multiple cuvettes.

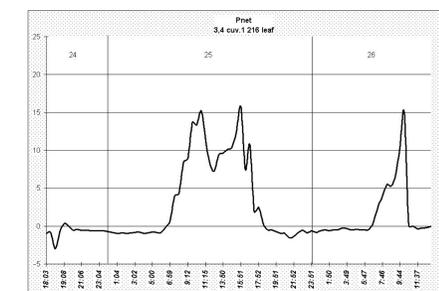
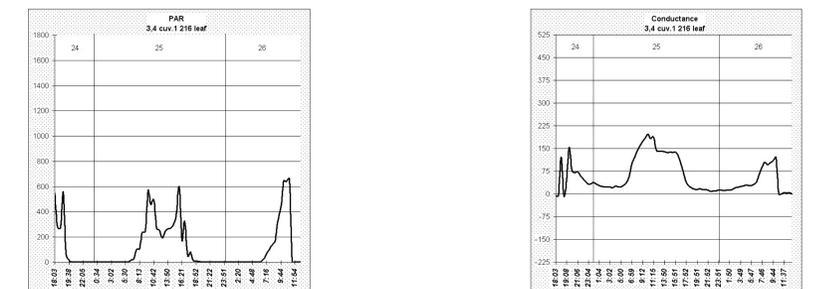


Fig. 9. Diurnal light, assimilation, conductance curves for CO₂, X O₂ treatment, 8/24/00- 8/26/00

