

Leaf-level gas exchange measurements in the Selhausen experimental field

Hugo J. de Boer, Utrecht University. Contact: h.j.deboer@uu.nl

Methods

Leaf gas exchange was measured using a Li-COR LI6400XT photosynthesis system. An overview of the different measurements (Table 1) is provided in the following.

Diurnal responses

Leaves were picked from the field in vicinity of the base station and quickly mounted in the leaf chamber. Typically two leaves were mounted adjacent to provide full cover of the 2x3cm gasket. Measurements consisted of tracking the diurnal response in stomatal conductance (g_{sw}) and subsequent changes in leaf gas exchange. Settings of leaf chamber PAR and CO₂ followed the diurnal variability measured in the field. Leaf chamber temperature was controlled between 20°C and 25°C. Relative humidity in the leaf chamber was controlled between 60% and 75%.

Maximum light-saturated photosynthetic capacity

Maximum light-saturated photosynthetic capacity (A_{max}) was measured under a light intensity PAR of 1500 $\mu\text{mol m}^{-2} \text{s}^{-1}$ and a reference CO₂ concentrations of 400 and 450 ppm. Measurements were conducted on excised leaves.

CO₂ response curves

CO₂ response curves were measured under a light intensity PAR of 1500 $\mu\text{mol m}^{-2} \text{s}^{-1}$ by subsequently changing the reference CO₂ concentration along the following order: 450, 50, 100, 150, 250, 350, 450, 600, 800, 1200 pp. Measurements were conducted on attached leaves. Leaves were allowed to equilibrate in terms of gas exchange, but not in terms of stomatal aperture.

Light response curves

Light response curves were measured under a reference CO₂ concentration of 450 ppm. PAR values were subsequently changed along the following order: 0, 25, 50, 100, 200, 400, 800, 1200 1500 $\mu\text{mol m}^{-2} \text{s}^{-1}$. Measurements were conducted on attached leaves. Leaves were allowed to equilibrate in terms of gas exchange, but not in terms of stomatal aperture.

Table 1: Overview of the leaf gas exchange measurements conducted at the Selhausen experimental site.

Date / measurement	Diurnal	A_{max}	A-C _i	A-PAR
7 May 2018	x	x		
8 May 2018		x	x	x
15 June 2018	x	x		
28 June 2018	x	x	x	

Results

Diurnal response

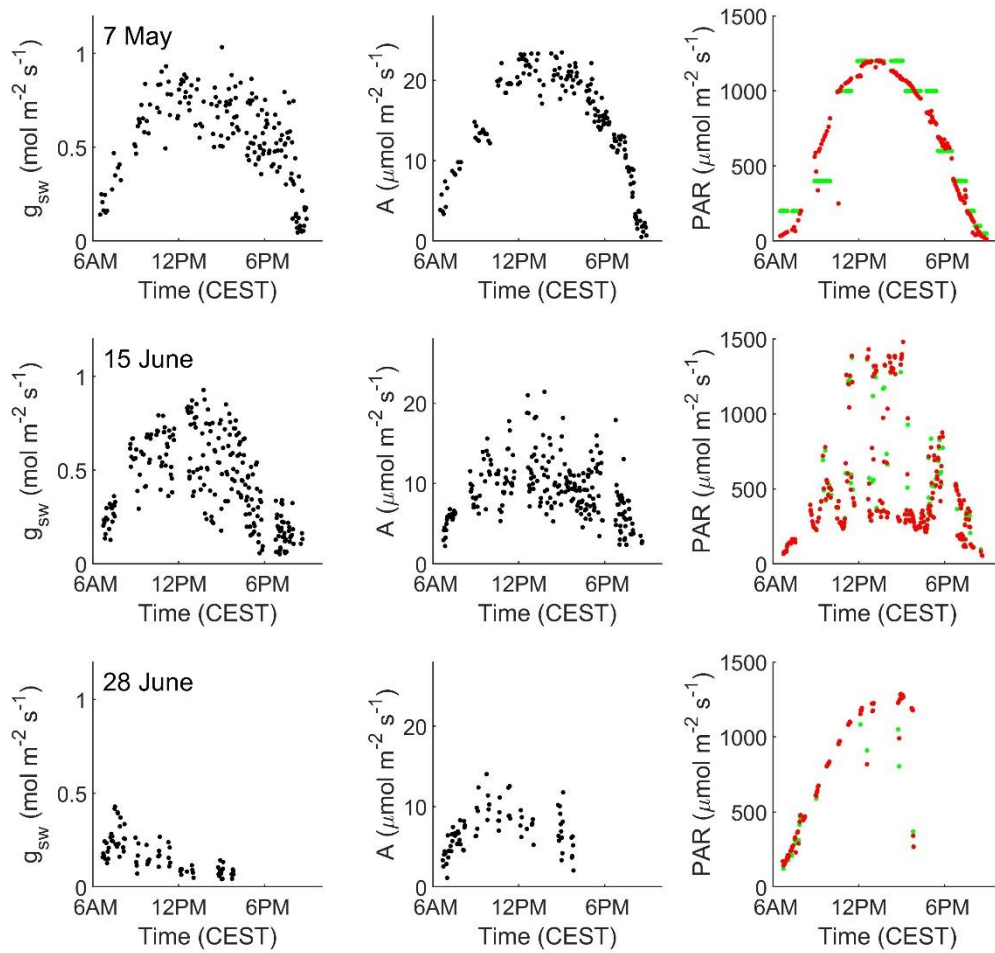


Figure 1: Diurnal responses in stomatal conductance to water vapor (g_{sw}) and photosynthesis (A) measured on 7 May, 15 June and 28 June. Measurements were conducted by varying the reference CO₂ level and photosynthetic active radiation (PAR) in parallel with the changes occurring in the field. Measured PAR is indicated by red markers in the right panels, prescribed PAR by the green markers.

Photosynthesis parameters

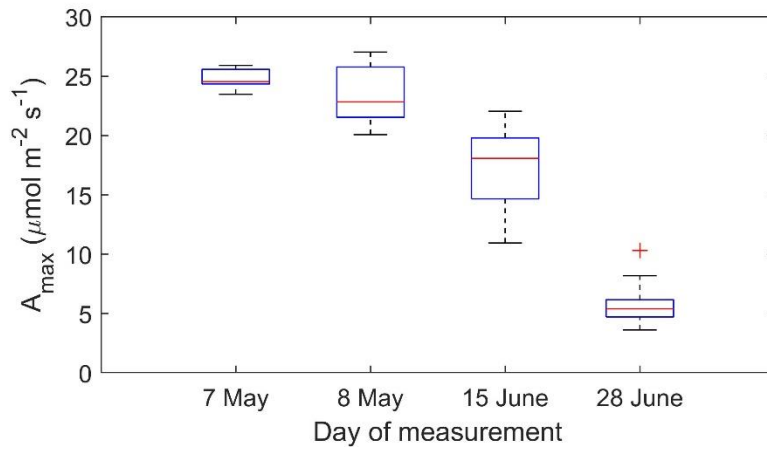


Figure 2: Maximum photosynthetic capacity at saturating light ($A_{\max}$) measured on four days.

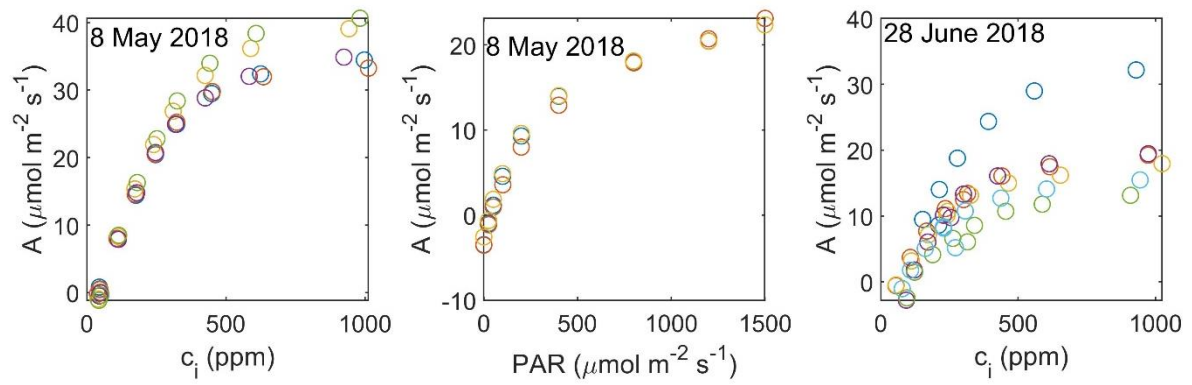


Figure 3: CO_2 and light response curves. CO_2 response curves were measured on the 8th of May and the 28th of June 2018. Light response curves were measured only on the 8th of May.