

Tests of the Effects of CO₂ Ramping Rate on A vs. C_i Curves with CIRAS-3

Some researchers have published data and opinions that ramping CO₂ to rapidly create A-Ci curves is only applicable for the relatively slow ramp rate of 100 ppm/min.^{1,2} We have not found this limitation when using the CIRAS-3 Portable Photosynthesis System. We demonstrate here that ramp rates from 100 ppm/min to 233 ppm/min produce identical results on real leaves, both in A-Ci curve data and in the parameters inferred from those curves. While each researcher must carefully assess the applicability of the rapid A-Ci technique in their particular field of interest, the 100 ppm/min is not a universal limitation of the technique, and is certainly not a limitation displayed by the CIRAS-3.

Tests of CO₂ ramping speeds of 100, 150 and 233 ppm per minute were made on the same leaves, for two C₃ species. Soybeans and velvetleaf were measured at 25 °C, at a PPFD of 1500 μmol m⁻² s⁻¹. The VPD was 1.5 kPa.

Results

The A vs. C_i curves developed from the three CO₂ ramping speeds differed very little with ramp speed in either species (Fig. 1 & 2). The slightly lower initial slope of the curve at the highest ramp speed in velvetleaf did not occur in soybeans. Photosynthetic parameters estimated from these curves did not differ substantially with ramp speed, as evidenced by the small standard errors (Table 1).

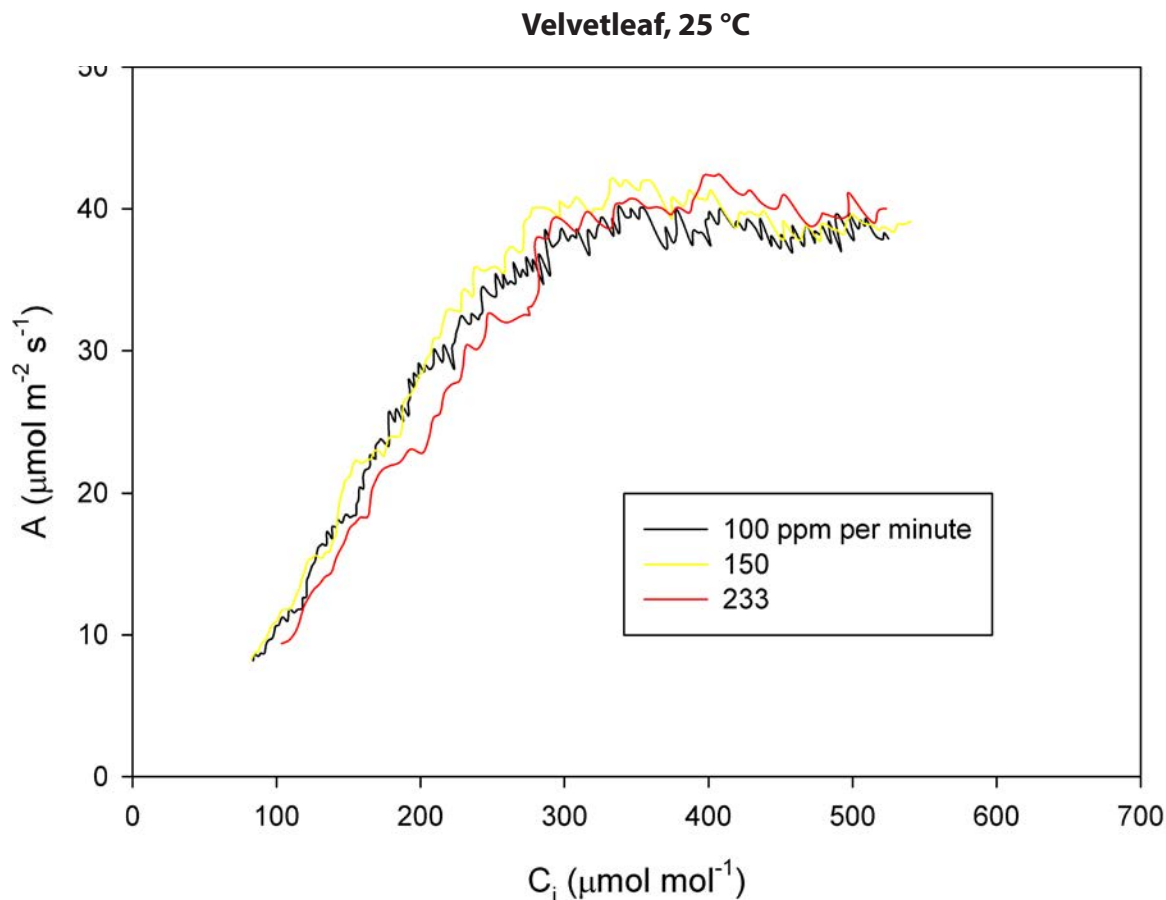


Figure 1

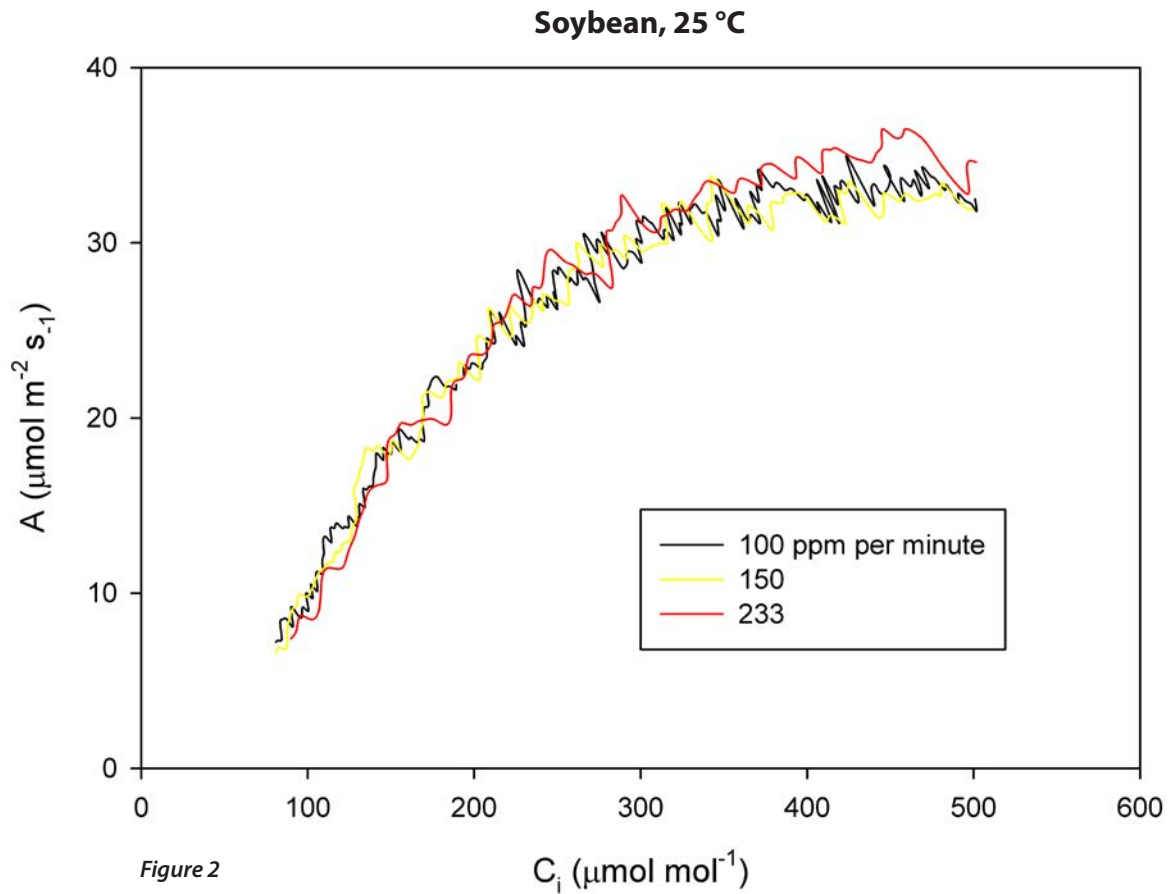


Table 1. Photosynthetic parameters (\pm std err) estimated from A vs. C_i curves for three CO₂ ramping speeds, in soybean and velvetleaf.

Species	VCmax	J	TPU	Rd	gm
		($\mu\text{mol m}^{-2} \text{s}^{-1}$)			($\text{mmol m}^{-2} \text{s}^{-1}$)
Velvetleaf	172 \pm 7	261 \pm 4	14.3 \pm 0.2	5.1 \pm 0.5	1.5 \pm 0.3
Soybean	137 \pm 2	202 \pm 1	12.3 \pm 0.6	4.2 \pm 0.4	0.4 \pm 0.1

References:

1. Stinziano, J. R., McDermitt, D. K., Lynch, D. J., Saathoff, A. J., Morgan, P. B. and Hanson, D. T. (2018), The rapid A/C_i response: a guide to best practices. *New Phytol.* . doi:10.1111/nph.15383
2. Taylor, S. H. and Long, S. P. (2018), Phenotyping photosynthesis on the limit – a critical examination of RACiR. *New Phytol.* . doi:10.1111/nph.15382



If you would like to learn more about this application or speak with one of our experienced technical staff, please feel free to get in direct contact with us via any of the contact information listed below:

110 Haverhill Road, Suite 301
Amesbury, MA 01913 U.S.A.

Tel: +1 978-834-0505
Fax: +1 978-834-0545

support@ppsystems.com
ppsystems.com

- @pp_systems
- company/pp-systems
- ppsystems.intl
- ppsystemsinc