Supplementary Table S1

Coefficients, r^2 value, and the irradiance at which $J_{NPQ}/ETR=1$ presented from polynomial regression ($y=ax^2+bx+c$, $c=0$) applied to the dataset for each cultivar in Figure 8.

Cultivar	Coefficient a	Coefficicent b	r^2	Irradiance where $J_{NPQ}/ETR=1$, ($\mu mols\ m^{-2}\ s^{-1}$)
Azucena	9.78	2.4	0.92	817.04
MAGIC	1.09	1.74	0.86	814.04
Moroberekan	9.12	-2.04	0.85	1125.22
IR64-21	2.003	-1.9	0.9	565.06

Supplementary Table S2

Plant architectural measurements made in 5 cultivars of *Oryza sativa* grown and analysed in quarantine glasshouse facilities at CSIRO, Black Mountain, Canberra, Australia. Measurements were made by hand at 100 days after sowing (DAS).

Genotype	Plant Height (mm) at 100DAS	Leaf width (mm), Leaf 8	Leaf angle from stem[a] (˚)	SPAD[b]	Tillers at 100DAS
Azucena	1203.75 ± 15.6	15.25 ± 0.9	18.75 ± 1.3	37.75 ± 0.6	11 ± 0.4
IR64-21	700 ± 7.4	9.25 ± 0.5	32.5 ± 1.3	42.63 ± 0.9	>15
Moroberekan	1168.75 ± 28.6	15 ± 0.4	23.75 ± 1.4	36.58 ± 0.7	>9 ± 0.4
Nipponbare	765 ± 9.3	11 ± 0.4	31.25 ± 1.2	36.9 ± 1.7	>15
MAGIC	732.5 ± 11.3	8.5 ± 0.3	30 ± 0	41.92 ± 0.7	>15
Significance[c]	*p<0.001*	*p<0.001*	*p<0.001*	*p<0.01*	

[a] *average of leaf 8, 9, 10, and 11in all genotypes*

[b] *SPAD gives surrogate leaf chlorophyll with non destructive measurement. See section 2.6. Unit is arbitrary, proportional to chlorophyll content.*

[c] *single factor ANOVA variation between genotypes.*

Supplementary Table S3

Absorption values for 5 cultivars of *Oryza sativa*. Calculations are made from measurements of four repetitions of leaf 8, with an integrating sphere (ASD Inc. Boulder, CO, USA) across the full spectrum (400-2500 nm). Presented values are the average across the PAR spectrum range (460-700 nm) with the standard error of the mean for the averaged value. Calculations are given in supplementary Appendix.

Cultivar	Absorption value
Azucena	0.84 ± 0.0036
IR64-21	0.84 ± 0.033
MAGIC	0.85 ± 0.0066
Moroberekan	0.87 ± 0.0059
Nipponbare	0.84 ± 0.0029

Supplementary figures

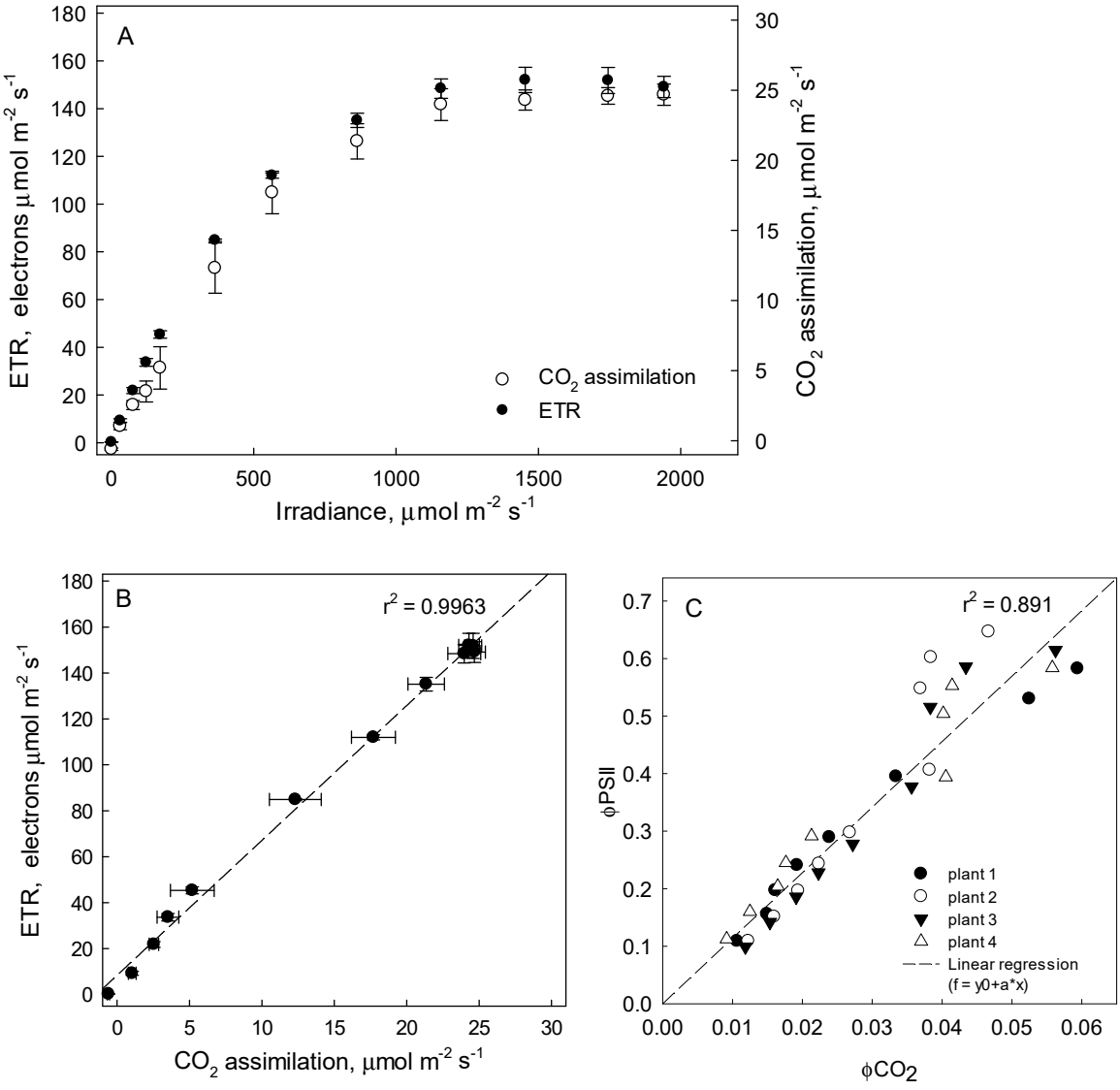

Figure S1

The response of CO_2 assimilation and ETR to irradiance in leaf 8 on four plants of Nipponbare (A). Conventional light response curves (total time 40mins) were made with LiCor fluorescence chamber head (0-2000 µmol m^{-2} s^{-1} irradiance at 25°C with 400 µmol/mol CO_2) n=4. The relationship between ETR and CO_2 assimilation, regression f=8.46+5.87*x (B) and the relationship between ϕPSII and ϕCO_2 , regression f=0.015+10.99*x (C) was calculated for the curves in panel A.

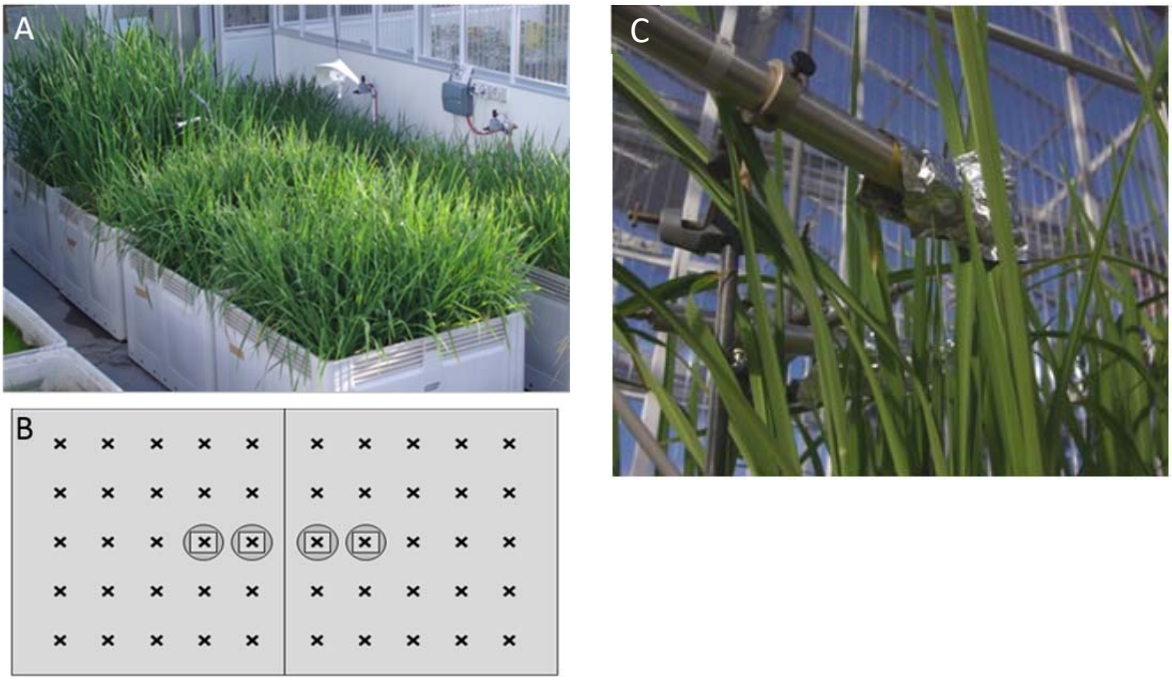

Figure S2

Mini canopies of *Oryza sativa*, sown in a controlled environment glasshouse at CSIRO, Black Mountain, Canberra. Plants were transplanted with 25x25cm spacing, in 650 litre bins (1162x1162x650mm), into 'puddled' soil (A). In the layout of mini canopies, aerial view, (B), **X** represents plants sown directly into soil. **X** inside squares represents plants sown into smaller pots (220mm x 220mm, 10 ltr), placed into the soil of larger bin, to allow temporary removal for architectural analysis of single plants, but to ensure growth in realistic canopy light environment. Two bins next to each other compose a mini canopy.

Monitoring PAM measuring head set to take a conventional light response curve measurement (C). Aluminium foil blocks out natural intercepted light to allow the actinic light source to apply increasing irradiance (0-1500µmol m^{-2} s^{-1}) with 3min acclimation time at each irradiance. Rapid light response curves were made without moving the measuring heads on the same leaf area measured diurnally.

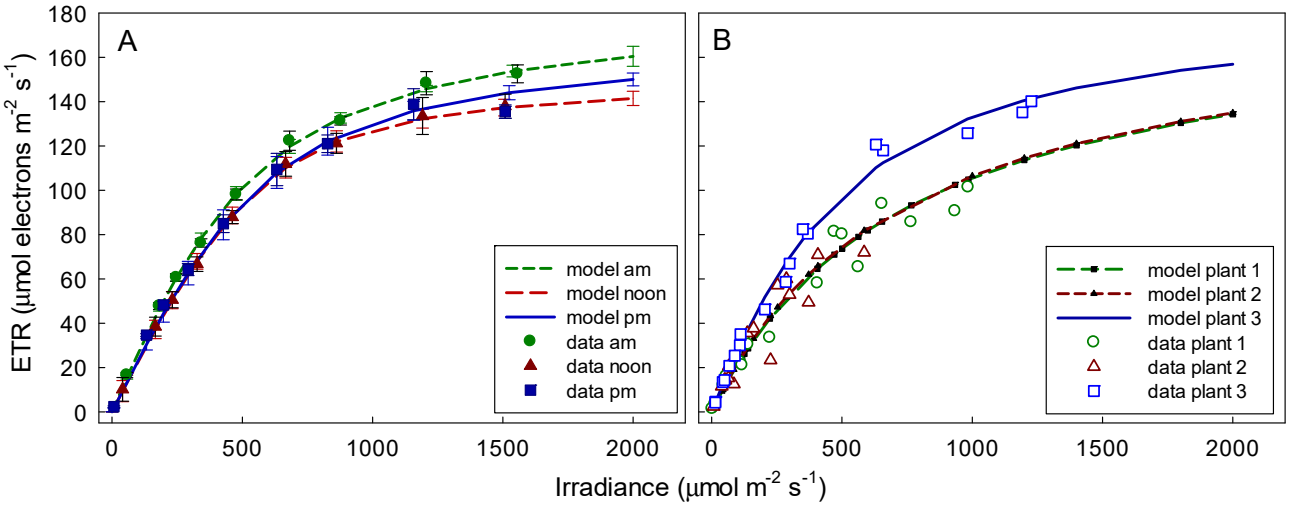

Figure S3

The measured response of ETR to irradiance compared with model predictions in leaf 13 of cv. Nipponbare at 122 DAS for conventional light response curves (A) and diurnally from saturating PAM fluorescence flashes made at 30 minute intervals throughout the day (B). The model was generated with Equation 3 using the Microsoft Excel curve fitting utility attached as supplemetary material. For the rapid response curve data and model at three timepoints, n=3 (A), while diurnal measurements from leaf 13 of three plants are shown individually (B).

Supplementary Appendix

Calculation of leaf absportion values with an integrating sphere and Fieldspec4 (*Analytical Spectral Devices (ASD) Inc., Boulder, CO, USA).*

Leaf 8 from 4 plants of 5 cultivars of *Oryza sativa* (Azucena, IR64-21, Moroberekan, Nipponbare and MAGIC), were analysed with the integrating sphere. Fractionating reflection and transmittance across the PAR spectrum (400-700nm) allowed calculation of absorption in the PAR range with for each genotype according to:

$$\alpha\lambda = 1 - \rho\lambda - \tau$$

Where ($\rho\lambda$) is radiation reflected or transmitted ($\tau\lambda$) transmitted and ($\alpha\lambda$) is absorption

The device was set up and located outside of the glasshouse, in the adjacent anteroom in darkened conditions. To make a measurement, a leaf was detached from the plant in a mini canopy in the glass house.

The device was set to make measurements in 'ratio mode', and for greater accuracy a stray light measurement was made across the full spectrum prior to measurement on each leaf. Thus the reflectance value as a ratio of total radiation at a given wavelength was calculated as:

$$\mathrm{Rs} = \frac{\left(\mathrm{R's} - \mathrm{Rd}\right) \cdot \mathrm{Rr}}{(1 - \mathrm{Rd})}$$

where Rs is the corrected sample reflectance, R's is measured sample reflectance, Rr is reference sample reflectance, and Rd is the stray light measurement.

In a similar way, but with a dark reading rather than a stray light measurement, transmittance value for each wavelength was calculated as:

$$\mathrm{T} = \frac{(\mathrm{Is} - \mathrm{Id}) \cdot \mathrm{Rr}}{(1 - \mathrm{Id})}$$

where T is corrected transmittance, Is is the transmittance sample measurement, and Id is the transmittance dark reading. Stray light measurements were always below 0.08, and dark measurements always below 0.009, and considered very low.

An average of the absorption values in the PAR spectrum only were used to calculate leaf absorption.