

Description of data associated with *“Open-source LED lamp for the LI-6800 photosynthesis system”* paper.

Summary

In this work, a cost-effective lamp compatible with the LI-6800 photosynthesis measuring system was developed. The lamp uses a white Light Emitting Diode (LED). As an example usage for the lamp, assimilation rate was measured at several light intensities. We used BORLAUG100 F2014 wheat line in 2022. In addition, photosynthetic parameters were estimated from these measurements according to Rivera-Méndez and Romero (2017). Data and methods files are in the format according to the recommendations of Ely et al. (2021), following the example of Rogers et al. (2019).

The data described in this text is available on:

https://github.com/AaronVelez/LI-6800_Lamp/tree/main/Data

The experiments associated with this data is published on the following paper:

[LINK TO Applications in Plant Science Journal Paper](#)

Data Files

Data files:

- LI-6800_Lamp_AQ_curves.csv
- LI-6800_Lamp_AQ_fitted_params.csv
- LI-6800_Lamp_AQ_curves_instrument_output.csv

Methods and metadata files:

- LI-6800_Lamp_methods_AQ_curves.csv
- LI-6800_Lamp_methods_AQ_params.csv
- LI-6800_Lamp_instrument_details.csv

Data characteristics

Location	Escuela Nacional de Estudios Superiores, Unidad León, León, Guanajuato, México.
Latitude	21°02'44.2" N
Longitude	101°40'17.3" W

Altitude 1.787 m ASL
Date from 2022-03-28
Date to 2022-03-28

Data dictionaries

LI-6800_Lamp_AQ_curves.csv

Number of records: 40

Header	Format	Units	Definition
USDA_Species_Code	Alphanumeric string	-	Code to identify the plant species used in measurements according the USDA
Sample_ID	Alphanumeric string	-	Identifier used for each sample
Date	Integer	YYYYMMDD	Date of observations
Time	HH:MM:SS	HH:MM:SS	Time of observations, set to local time (UTC-6)
A	Float	$\mu\text{mol m}^{-2} \text{s}^{-1}$	CO ₂ assimilation rate per leaf area
Ci	Float	$\mu\text{mol mol}^{-1}$	Intercellular CO ₂ concentration
CO2_S	Float	$\mu\text{mol mol}^{-1}$	CO ₂ concentration in air inside chamber
Patm	Float	kPa	Atmospheric pressure
Qin	Float	$\mu\text{mol m}^{-2} \text{s}^{-1}$	In-chamber photosynthetic flux density (PPFD) incident on the leaf, quanta per area
RHs	Float	%	Relative humidity of air inside the chamber
Tleaf	Float	°C	Leaf surface temperature

LI-6800_Lamp_AQ_fitted_params.csv

Number of records: 4

Header	Format	Units	Definition
USDA_Species_Code	Alphanumeric string	-	Code to identify the plant species used in measurements according the USDA
Sample_ID	Alphanumeric string	-	Identifier used for each sample
Date	Integer	YYYYMMDD	Date of observations
Rd	Float	$\mu\text{mol m}^{-2} \text{s}^{-1}$	Dark respiration rate derived only from the light response curve. Reported as a positive value
Amax	Float	$\mu\text{mol m}^{-2} \text{s}^{-1}$	Maximum CO ₂ assimilation rate
K	Float	$\mu\text{mol m}^{-2} \text{s}^{-1}$	Light saturation constant
A_model	Float	$\mu\text{mol m}^{-2} \text{s}^{-1}$	CO ₂ assimilation rate modeled using the estimated parameters

LI-6800_Lamp_AQ_curves_instrument_output.csv

Number of records: 40

This file is the output file obtained from the LI-6800 photosynthesis measuring system. In the following table, we only describe the user-defined constants and variables. The definitions for the other variables can be obtained from the LI-6800 console by navigating to *Start Up > Data Dictionary*.

Header	Format	Units	Definition
Lamp_Qamb_in_Factor	Float	-	Lamp mismatch factor between Qamb_in and Lamp_PAR_Ctrl
Lamp_T_Ctrl	Float	°C	Lamp temperature setpoint
Lamp_T_trinket_V_Ctrl	Float	V	Lamp input Trinket voltage
Lamp_T_DAC2_V_Ctrl	Float	V	Lamp output Li-6800 voltage from auxiliary channel 2
Lamp_T_TH-r	Float	kohms	Lamp thermistor resistance. Measurement ADC_CH1 to thermistor resistance
Lamp_PAR_Ctrl	Float	$\mu\text{mol m}^{-2} \text{s}^{-1}$	Lamp desired PAR setpoint
Lamp_T	Float	°C	Lamp temperature. Measurement thermistor temperature to thermistor resistance

Example Data Records:

LI-6800_Lamp_AQ_curves.csv

USDA_Species_Code	Sample_ID	Date	Time	A ?mol m-2 s-1	Ci ?mol mol-1	CO2_s ?mol mol-1	Patm kPa	Qin ?mol m-2 s-1	RHs %	Tleaf °C
-	-	YYYYMMDD	HH:MM:SS							
TRITI	P1T	20220328	14:02:54	-0.67596	131.3565	400.9432	82.30614	-0.26493	61.71509	24.80399
TRITI	P1T	20220328	14:09:33	0.130456	373.7126	399.6382	82.29211	40.62016	62.09777	24.90932
TRITI	P1T	20220328	14:24:11	2.116751	266.0539	397.7436	82.27619	93.25127	62.58873	24.90085

LI-6800_Lamp_AQ_fitted_params.csv

USDA_Species_Code	Sample_ID	Date	Rd ?mol m-2 s-1	Amax ?mol m-2 s-1	K ?mol m-2 s-1	A_model ?mol m-2 s-1
-	-	YYYYMMDD				
TRITI	P1T	20220328	1.590662	30.71135	532.8794	-1.59066
TRITI	P2T	20220328	2.221156	30.58111	438.4365	-2.22116
TRITI	P3T	20220328	1.671797	31.01813	535.5329	0.265399

LI-6800_Lamp_AQ_curves_instrument_output.csv
(Only the first 15 columns are shown)

Sys Obs	SysO bs	Sys Obs elap sed	SysObs date	SysO bs hhm mss	SysO bs avera ging	UserDefCon Lamp_Qamb _in_Factor	UserDe fCon Lamp_ T_Ctrl	UserDefVar Lamp_T_trin ket_V_Ctrl	UserDefVar Lamp_T_DA C2_V_Ctrl	UserDe fVar Lamp_T _TH-r	UserDef Var Lamp_P AR_Ctrl	UserD efVar Lamp_ T	GasE x TIME	GasEx E mol m ² s ⁻¹
obs	time	s			s		°C	V	V	kohms	μmol m- 2 s-1	°C	s	s ⁻¹
1	1.65 E+09	0	20220328 14:02:54	14:0 2:54	5	1	30	1.2375	1.165835	9.5081 39	0	26.15 356	1.65 E+09	6.21E- 05
2	1.65 E+09	399. 4	20220328 14:09:33	14:0 9:33	5	1	30	1.2375	1.165835	9.5221 23	39.9999 8	26.11 982	1.65 E+09	0.000 188
3	1.65 E+09	127 7	20220328 14:24:11	14:2 4:11	5	1	30	1.2375	1.165835	9.1133 28	79.9999 6	27.13 039	1.65 E+09	0.000 405

Data Acquisition Materials and Methods

Instrument: LI-6800 photosynthesis measuring system.

The complete methods for the light response curve is available in:

https://github.com/AaronVelez/LI-6800_Lamp/blob/main/Software/A-PPFD_Curve.py

References

Ely, K. S., Rogers, A., Agarwal, D. A., Ainsworth, E. A., Albert, L. P., Ali, A., ... Yang, D. (2021). A reporting format for leaf-level gas exchange data and metadata. *Ecological Informatics*, 61, 101232. <https://doi.org/10.1016/j.ecoinf.2021.101232>

Rogers, A., Serbin, S. P., Ely, K. S., & Wullschleger, S. D. (2019). Terrestrial biosphere models may overestimate Arctic CO₂ assimilation if they do not account for decreased quantum yield and convexity at low temperature. *New Phytologist*, 223(1), 167–179. <https://doi.org/10.1111/nph.15750>

Rivera-Méndez, Y. D., & Romero, H. M. (2017). Fitting of photosynthetic response curves to photosynthetically active radiation in oil palm. *Agronomía Colombiana*, 35(3), 323-329.