

Table 2S. The measured apparent quantum yield ($\Phi_{\text{PPFD} \leq 200}$, $\Phi_{\text{PPFD} \leq 160}$, $\Phi_{\text{PPFD} \leq 120}$), light saturation point (LSP), light-saturated net photosynthetic rate (P_{Nmax}), light compensation point (LCP), dark respiration rate (R_D) and their fitted values using the four models for *Hippophae rhamnoides* under different relative soil water contents (RWC). Each value is the mean of 27 replications or the mean $\pm$ SE of the fitted parameters at 0.05 significant level. The coefficient of determination (R^2), the mean square error (MSE) and the mean absolute error (MAE) are listed for each model. $\Phi_{\text{PPFD} \leq 200}$, $\Phi_{\text{PPFD} \leq 160}$, $\Phi_{\text{PPFD} \leq 120}$ are the apparent quantum yield when the upper limits of photosynthetic photon flux density (PPFD) are 200, 160, and 120 $\mu\text{mol m}^{-2} \text{s}^{-1}$, respectively; Φ_0 and Φ_c are the quantum yield at the light compensation point and at zero irradiance, respectively; Φ_{c0} is the absolute value of the slope of the photosynthetic rate-light response curve between zero irradiance and LCP.

Model	Parameter	RWC = 95.86%	RWC = 82.86%	RWC = 71.69%	RWC = 59.51%	RWC = 47.94%	RWC = 38.49%	RWC = 30.00%	RWC = 26.00%
Measured data	$\Phi_{\text{PPFD} \leq 200}$	0.0163	0.0319	0.0443	0.0328	0.0266	0.0197	0.0174	0.0148
	$\Phi_{\text{PPFD} \leq 160}$	0.0166	0.0321	0.0445	0.0335	0.0269	0.0206	0.0179	0.0157
	$\Phi_{\text{PPFD} \leq 120}$	0.0168	0.0326	0.0447	0.0352	0.0273	0.0216	0.0183	0.0164
	LSP [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	994	1218	1425	1212	1013	1003	784	790
	P_{Nmax} [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	6.39	12.01	15.63	13.52	10.29	9.43	4.93	3.29
	LCP [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	83.33	44.00	62.33	60.33	67.33	55.67	84.67	63.67
	R_D [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	0.90	1.19	2.61	2.00	1.79	1.47	1.34	0.99
	Φ_0	0.472 $\pm$ 0.024	0.0655 $\pm$ 0.015	0.0883 $\pm$ 0.016	0.0761 $\pm$ 0.014	0.0577 $\pm$ 0.012	0.457 $\pm$ 0.11	0.725 $\pm$ 0.036	0.639 $\pm$ 0.042
	Φ_c	0.0554	0.0514	0.0613	0.0543	0.0389	0.1363	0.1551	0.0513
	Φ_{c0}	0.1617	0.0580	0.0735	0.0643	0.0474	0.2495	0.3354	0.1810
	LSP [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	480	682	700	675	400	368	298	178
	P_{Nmax} [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	8.0 $\pm$ 0.90	17.87 $\pm$ 0.58	23.40 $\pm$ 0.96	20.76 $\pm$ 0.83	15.57 $\pm$ 0.72	13.57 $\pm$ 0.72	8.02 $\pm$ 0.77	5.19 $\pm$ 0.76
	LCP [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	32.54	35.16	53.16	50.26	58.91	24.68	12.85	20.55
Non-rectangular hyperbola model	R_D [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	5.26 $\pm$ 0.81	2.04 $\pm$ 0.51	3.91 $\pm$ 0.79	3.23 $\pm$ 0.71	2.79 $\pm$ 0.60	6.16 $\pm$ 0.56	4.31 $\pm$ 0.84	3.72 $\pm$ 0.81
	R^2	0.678	0.988	0.983	0.983	0.976	0.974	0.732	0.638
	MSE	0.853	0.117	0.359	0.084	0.158	0.506	0.532	0.380
	MAE	0.799	0.254	0.399	0.200	0.289	0.602	0.592	0.493
	Φ_0	0.2861 $\pm$ 0.017	0.0386 $\pm$ 0.003	0.0542 $\pm$ 0.001	0.0415 $\pm$ 0.003	0.0292 $\pm$ 0.002	0.2182 $\pm$ 0.015	0.293 $\pm$ 0.031	0.0047 $\pm$ 0.005
	Φ_c	0.0128	0.0278	0.0338	0.0332	0.0237	0.2143	0.1087	0.0032
	Φ_{c0}	0.0196	0.0283	0.0445	0.0353	0.0259	0.2172	0.1128	0.0338
	LSP [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	31	704	743	707	493	470	320	230
	P_{Nmax} [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	2.56 $\pm$ 0.57	17.13 $\pm$ 0.21	22.17 $\pm$ 0.37	18.55 $\pm$ 0.27	12.95 $\pm$ 0.33	10.47 $\pm$ 0.42	1.87 $\pm$ 0.49	1.39 $\pm$ 0.79
	LCP [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	150.17	42	58.67	61.67	68.08	27.12	41.67	99.67
	R_D [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	2.95 $\pm$ 1.29	1.19 $\pm$ 0.10	2.61 $\pm$ 0.22	2.18 $\pm$ 0.14	1.76 $\pm$ 0.14	5.89 $\pm$ 0.12	4.7 $\pm$ 0.19	3.37 $\pm$ 0.25
	R^2	0.802	0.999	0.999	0.999	0.999	0.998	0.659	0.603
	MSE	10.826	0.015	0.074	0.032	0.027	0.327	4.814	2.851
	MAE	2.070	0.105	0.226	0.155	0.146	0.131	1.370	1.171
Exponential	Φ_0	0.0327 $\pm$ 0.029	0.0568 $\pm$ 0.006	0.0683 $\pm$ 0.008	0.0572 $\pm$ 0.009	0.0434 $\pm$ 0.009	0.0347 $\pm$ 0.011	0.0372 $\pm$ 0.025	0.0313 $\pm$ 0.019

Modified rectangular hyperbola model	Φ_e	0.0024	0.0499	0.0579	0.0478	0.0357	0.0302	0.0206	0.0141
	Φ_{e0}	0.0141	0.0517	0.0676	0.0540	0.0396	0.034	0.0269	0.0157
	LSP [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	540	797	937	784	533	511	108	298
	$P_{N\text{max}}$ [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	6.95 ± 0.92	13.65 ± 0.59	19.51 ± 0.89	16.40 ± 0.94	12.71 ± 0.75	11.19 ± 0.74	6.77 ± 0.50	4.39 ± 0.52
	LCP [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	100.33	31.33	47.33	51.67	57.33	45.03	108	111.67
	R_p [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	1.41 ± 0.57	1.62 ± 0.18	3.20 ± 0.35	2.79 ± 0.31	2.27 ± 0.30	1.53 ± 0.31	2.90 ± 0.48	1.75 ± 0.50
	R^2	0.724	0.998	0.996	0.995	0.992	0.99	0.692	0.665
	MSE	0.534	0.055	0.125	0.169	0.174	0.456	0.531	0.574
	MAE	0.622	0.212	0.378	0.346	0.392	0.548	0.649	0.696
	Φ_0	0.0254	0.0458	0.0657	0.0533	0.0400	0.0300	0.0386	0.0241
	Φ_e	0.0219	0.0414	0.0614	0.0514	0.0360	0.0264	0.0275	0.013
	Φ_{e0}	0.0245 ± 0.004	0.0419 ± 0.003	0.0620 ± 0.005	0.0523 ± 0.005	0.0366 ± 0.004	0.0273 ± 0.007	0.0330 ± 0.006	0.0189 ± 0.009
	LSP [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	903	1272	1240	1258	1185	1197	864	748
	$P_{N\text{max}}$ [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	6.36	12.21	16.13	13.89	10.58	9.66	4.60	3.26
	LCP [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	49.33 ± 0.24	38.67 ± 0.19	51.33 ± 0.32	53.00 ± 0.33	59.05 ± 0.29	48.33 ± 0.19	86.33 ± 0.47	85.67 ± 0.53
	R_p [$\mu\text{mol m}^{-2} \text{s}^{-1}$]	1.21	1.62	3.18	2.77	2.16	1.32	2.85	1.62
	R^2	0.9960	0.9989	0.9976	0.9978	0.9973	0.9976	0.9977	0.9978
	MSE	0.056	0.058	0.024	0.016	0.012	0.473	0.028	0.010
	MAE	0.205	0.212	0.297	0.234	0.211	0.235	0.148	0.085