Supplemental Table S1. Dynamic monitoring of leaf area index of six mulberry varieties.

Date	Yu 711 LAI ($m^2 \cdot m^{-2}$) M±SD	Jin 10 LAI ($m^2 \cdot m^{-2}$) M±SD	Zhongsang 9703 LAI ($m^2 \cdot m^{-2}$) M±SD	Husang 32 LAI ($m^2 \cdot m^{-2}$) M±SD	Zhongsang 1302 LAI ($m^2 \cdot m^{-2}$) M±SD	Suhu 16 LAI ($m^2 \cdot m^{-2}$) M±SD
June 10	0.83±0.02	0.88±0.10	0.88±0.05	1.01±0.02	0.99±0.04	0.94±0.11
June 15	0.84±0.08	0.92±0.09	0.91±0.02	1.14±0.04	1.01±0.02	1.10±0.03
July 4	1.49±0.00	1.59±0.03	1.54±0.09	1.61±0.04	1.74±0.03	1.71±0.13
July 11	1.59±0.04	1.60±0.05	1.68±0.11	1.83±0.09	2.02±0.17	1.72±0.09
July 25	1.69±0.56	1.75±0.13	1.98±0.20	1.98±0.15	2.20±0.28	2.01±0.13
August 14	1.75±0.35	1.68±0.32	2.15±0.15	2.04±0.20	3.32±0.31	3.42±0.40
August 25	3.23±0.12	3.26±0.20	3.23±0.24	3.31±0.28	5.46±0.87	6.56±0.24

Date represents ‘measurement date’, M and SD represent ‘mean’ and ‘standard deviation’ respectively, $^{Yu\ 711}$LAI, $^{Jin\ 10}$LAI, $^{Zhongsang\ 9703}$LAI, $^{Husang\ 32}$LAI, $^{Zhongsang\ 1302}$LAI, and $^{Suhu\ 16}$LAI represent the leaf area index of ‘Yu 711’, ‘Jin 10’, ‘Zhongsang 9703’, ‘Husang 32’, ‘Zhongsang 1302’, and ‘Suhu 16’.

Supplemental Table S2. Chlorophyll content data.

Date	$^{Yu\ 711}$CHL (SPAD) M±SD	$^{Jin\ 10}$ CHL (SPAD) M±SD	$^{Zhongsang\ 9703}$ CHL (SPAD) M±SD	$^{Husang\ 32}$ CHL (SPAD) M±SD	$^{Zhongsang\ 1302}$ CHL (SPAD) M±SD	$^{Suhu\ 16}$ CHL (SPAD) M±SD
July 5	28.77±4.34	26.84±1.28	34.79±2.71	29.84±1.58	30.61±3.11	33.76±3.71
July 12	30.71±2.03	28.79±1.94	38.22±3.56	34.31±2.05	32.06±2.04	32.65±2.30
July 24	28.58±2.90	26.19±2.90	34.36±2.06	30.03±2.55	33.76±3.09	32.00±2.79
August 12	35.60±1.67	32.95±2.87	34.63±2.44	39.20±1.12	34.35±2.98	37.48±1.27
August 25	41.40±2.97	45.44±2.46	44.80±3.06	49.83±1.84	45.56±2.19	46.44±2.41

Date represents ‘measurement date’, M and SD represent ‘mean’ and ‘standard deviation’ respectively, $^{Yu\ 711}$CHL, $^{Jin\ 10}$ CHL, $^{Zhongsang\ 9703}$ CHL, $^{Husang\ 32}$ CHL, $^{Zhongsang\ 1302}$ CHL, $^{Suhu\ 16}$ CHL represents the Chlorophyll content of ‘Yu 711’, ‘Jin 10’, ‘Zhongsang 9703’, ‘Husang 32’, ‘Zhongsang 1302’, ‘Suhu 16’.

Supplemental Table S3. Weather conditions record in Zhenjiang City from June to August 2023.

Month	Weather situation		
	Sunny (days)	Cloudy (days)	Rainy (days)
June	10	8	12
July	4	8	19
August	12	1	18

Supplemental Table S4. Path analysis of dependent variable of P_N and independent variable of environmental factors.

Independent variable	Simple correlation coefficient with P_N	Direct path coefficient	Indirect path coefficient									
			Tr	Gs	Ci	WUE	Ta	Ti	PAR	RH	VPD	SUM
Tr	0.8582	1.4187		0.3195	- 0.0336	0.4956	- 0.2451	- 0.0460	- 0.3946	- 1.1133	0.4565	- 0.5609
Gs	0.9225	0.3610	1.2556		- 0.0183	0.5624	0.0579	- 0.3951	- 0.2926	- 1.1322	0.5233	0.5610
Ci	-0.5089	0.0471	- 1.0116	- 0.1401		- 0.2947	0.4967	- 0.3995	0.3584	0.6074	- 0.1724	- 0.5558
WUE	0.9490	0.7101	0.9903	0.2859	- 0.0195		0.2007	- 0.4612	- 0.2336	- 0.9765	0.4527	0.2387
Ta	-0.1079	-0.7325	0.4753	- 0.0285	- 0.0319	- 0.1946		0.8062	- 0.2526	- 0.0318	- 0.1171	0.6250
Ti	-0.4180	0.8938	- 0.0738	- 0.1596	- 0.0210	- 0.3664	- 0.6607		- 0.1278	0.4175	- 0.3208	- 1.3126
PAR	0.7073	-0.4303	1.3010	0.2455	- 0.0392	0.3856	- 0.4300	0.2655		- 0.9022	0.3109	1.1370

RH	0.9308	-1.1793	1.3393	0.3466	-	0.5879	-	-	-		0.5260	2.1102
					0.0242		0.0198	0.3164	0.3292			
VPD	-0.9049	-0.5474	-	-	0.0148	-	-	0.5238	0.2444	1.1333		-
			1.1832	0.3451		0.5872	0.1568					0.3560

Supplemental Table S5. Path analysis with P as the dependent variable and morphological index as the independent variable.

Independent variable	Simple correlation coefficient with PN	Direct path coefficient	Indirect path coefficient					
			P_N	LAI	H	CD	CHL	SUM
P_N	0.9494	1.2214		-0.1606	-0.0005	-0.1811	0.0703	-0.2719
LAI	0.6418	-0.2008	0.9771		-0.0006	-0.2450	0.1109	0.8424
H	0.5093	-0.0007	0.8965	-0.1791		-0.2755	0.0684	0.5103
CD	0.3464	-0.2959	0.7475	-0.1663	-0.0007		0.0618	0.6423
CHL	0.4577	0.1437	0.5973	-0.1550	-0.0003	0.0618		0.5038

Supplemental Table S6. Path analysis with P_{CO_2} as the dependent variable and morphological index as the independent variable.

Independent variable	Simple correlation coefficient with P_{CO_2}	Direct path coefficient	Indirect path coefficient					
			P_N	P	LAI	H	CD	CHL
P_N	0.8340	0.1056		0.0315	0.6764	-0.0677	0.0515	0.0365
P	0.6925	0.0332	0.1002		0.5428	-0.0470	0.0291	0.0342
LAI	0.9964	0.8455	0.0845	0.0213		-0.0823	0.0697	0.0576
H	0.8705	-0.0923	0.0775	0.0169	0.7542		0.0784	0.0355
CD	0.8067	0.0842	0.0646	0.0115	0.7001	-0.0859		0.0321
CHL	0.7867	0.0747	0.0517	0.0152	0.6528	-0.0439	0.0362	