

Effects of water stress on the sugar accumulation and organic acid changes in Cabernet Sauvignon grape berries

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Electronic supplementary material (ESM)

Table S1. Reference standard for different water stress treatments

Treatments	Setting-veraison	After veraison-harvest	Note
CK		mild ($-0.2 \text{ MPa} \geq \Psi_b \geq -0.4 \text{ MPa}$)	mild - mild
T1	mild ($-0.2 \text{ MPa} \geq \Psi_b \geq -0.4 \text{ MPa}$)	moderate ($-0.4 \text{ MPa} \geq \Psi_b \geq -0.6 \text{ MPa}$)	mild - moderate
T2		severe ($-0.6 \text{ MPa} \geq \Psi_b$)	mild - severe
T3		mild ($-0.2 \text{ MPa} \geq \Psi_b \geq -0.4 \text{ MPa}$)	moderate - mild
T4	moderate ($-0.4 \text{ MPa} \geq \Psi_b \geq -0.6 \text{ MPa}$)	moderate ($-0.4 \text{ MPa} \geq \Psi_b \geq -0.6 \text{ MPa}$)	moderate - moderate
T5		severe ($-0.6 \text{ MPa} \geq \Psi_b$)	moderate - severe
T6		mild ($-0.2 \text{ MPa} \geq \Psi_b \geq -0.4 \text{ MPa}$)	severe - mild
T7	severe ($-0.6 \text{ MPa} \geq \Psi_b$)	moderate ($-0.4 \text{ MPa} \geq \Psi_b \geq -0.6 \text{ MPa}$)	severe - moderate
T8		severe ($-0.6 \text{ MPa} \geq \Psi_b$)	severe - severe

Table S2. Irrigation time and irrigation quantity of each treatment groups

Treatments	Days after anthesis									Total irrigation volume
	18	38	45	55	68	77	98	108	118	
CK	3.0	6.6	7.8	8.6	2.7	13.5	1.8	6.0	16.6	66.6
T1	3.0	6.6	7.8	8.6	2.7	5.7	0.9	2.4	4.5	42.2
T2	3.0	6.6	7.8	8.6	2.7	3.9	—	0.8	3.3	36.7
T3	1.5	—	3.6	4.6	—	13.2	1.8	6.0	18.4	49.1
T4	1.5	—	3.6	4.6	—	9.9	0.9	2.4	7.5	30.4
T5	1.5	—	3.6	4.6	—	3.9	—	0.8	3.3	17.7
T6	—	—	4.8	4.5	—	14.4	1.8	6.0	16.6	48.1
T7	—	—	4.8	4.5	—	11.4	0.9	2.4	4.5	28.5
T8	—	—	4.8	4.5	—	3.9	—	0.8	3.3	17.3

— indicates no amount of irrigation

Unit — L•⁻¹

Table S3. Three kinds of sugar linear regression equation

Standards	Retention time/min	Regression equation	R value
Ffructose	8.666	$Y = 601948 X - 26418.3$	$R = 0.9996879$
Glucose	9.852	$Y = 532986 X - 46477$	$R = 0.9991250$
Ssucrose	15.025	$Y = 633297 X - 63664.7$	$R = 0.9985763$

Table S4. Effect of water stress on fructose content in grape berries

Treatments	40	60	80	90	100	110	120
CK	1.93 ± 0.03 ^c	19.58 ± 0.28b	37.93 ± 0.82b	65.18 ± 0.04e	75.40 ± 0.17d	81.70 ± 0.09d	81.43 ± 0.02d
T1	1.93 ± 0.03c	19.58 ± 0.28b	37.93 ± 0.82b	50.88 ± 0.29h	57.83 ± 0.07i	81.13 ± 0.11e	79.73 ± 0.17g
T2	1.93 ± 0.03c	19.58 ± 0.28b	37.93 ± 0.82b	59.05 ± 0.10g	65.33 ± 0.07h	78.85 ± 0.06g	80.15 ± 0.06f
T3	2.40 ± 0.05b	10.80 ± 0.05c	38.23 ± 0.3b	66.03 ± 0.08d	68.20 ± 0.06f	77.13 ± 0.12h	75.18 ± 0.07h
T4	2.40 ± 0.05b	10.80 ± 0.05c	38.23 ± 0.3b	66.70 ± 0.07c	83.90 ± 0.04a	82.80 ± 0.16c	90.88 ± 0.04a
T5	2.40 ± 0.05b	10.80 ± 0.05c	38.23 ± 0.3b	69.45 ± 0.11b	78.30 ± 0.32b	80.65 ± 0.11f	82.10 ± 0.07c
T6	3.18 ± 0.1a	37.50 ± 0.17a	56.38 ± 0.09a	70.03 ± 0.09a	76.60 ± 0.19c	84.83 ± 0.17a	82.18 ± 0.07c
T7	3.18 ± 0.1a	37.50 ± 0.17a	56.38 ± 0.09a	59.20 ± 0.05g	67.15 ± 0.21g	83.93 ± 0.04b	86.530 ± 0.09b
T8	3.18 ± 0.1a	37.50 ± 0.17a	56.38 ± 0.09a	60.20 ± 0.11f	71.58 ± 0.17e	75.93 ± 0.07i	80.88 ± 0.02e

Different lowercase letters in the same column indicate the difference of p < 0.05 level, the same blow;

Unit — mg/g F

Table S5. Effect of water stress on glucose content in grape berries

Treatments	Days after anthesis						
	40	60	70	90	100	110	120
CK	4.83 ± 0.02b	20.95 ± 0.08b	41.9 ± 0.09b	68.88 ± 0.10e	76.10 ± 0.11d	79.63 ± 0.46e	82.08 ± 0.32d
T1	4.83 ± 0.02b	20.95 ± 0.08b	41.9 ± 0.09b	53.60 ± 0.38g	60.40 ± 0.42h	86.48 ± 0.24b	81.15 ± 1.11d
T2	4.83 ± 0.02b	20.95 ± 0.08b	41.9 ± 0.09b	63.23 ± 0.05f	68.43 ± 1.36g	81.20 ± 0.36d	81.33 ± 0.21d
T3	4.75 ± 0.12b	14.88 ± 0.14c	40.68 ± 0.19c	71.30 ± 0.28b	70.88 ± 0.20ef	80.73 ± 0.15d	75.15 ± 0.74g
T4	4.75 ± 0.12b	14.88 ± 0.14c	40.68 ± 0.19c	70.35 ± 0.15d	86.68 ± 0.47a	93.08 ± 0.46a	103.03 ± 0.66a
T5	4.75 ± 0.12b	14.88 ± 0.14c	40.68 ± 0.19c	70.88 ± 0.07c	79.63 ± 0.46b	84.70 ± 0.41c	83.68 ± 0.27c
T6	6.43 ± 0.25a	40.43 ± 0.08a	58.40 ± 0.24a	72.78 ± 0.17a	78.33 ± 0.39c	85.00 ± 0.36c	79.55 ± 0.26e
T7	6.43 ± 0.25a	40.43 ± 0.08a	58.40 ± 0.24a	62.88 ± 0.09f	70.48 ± 0.36f	86.98 ± 0.45b	87.08 ± 0.66b
T8	6.43 ± 0.25a	40.43 ± 0.08a	58.40 ± 0.24a	63.15 ± 0.47f	71.83 ± 0.29e	75.50 ± 0.38f	77.88 ± 0.86f

Unit — mg/g FW

Table S6. Effect of water stress on sucrose content in grape berries

Treatments	Days after anthesis						
	40	60	70	90	100	110	120
CK	2.13 ± 0.07b	2.98 ± 0.07c	4.43 ± 0.10b	5.53 ± 0.07cde	6.15 ± 0.02e	6.53 ± 0.28d	8.15 ± 0.04e
T1	2.13 ± 0.07b	2.98 ± 0.07c	4.43 ± 0.10b	3.58 ± 0.13f	3.75 ± 0.06g	7.18 ± 0.03c	7.95 ± 0.08f
T2	2.13 ± 0.07b	2.98 ± 0.07c	4.43 ± 0.10b	5.20 ± 0.06de	5.18 ± 0.05f	5.33 ± 0.08e	7.48 ± 0.02h
T3	2.85 ± 0.06a	3.21 ± 0.08b	3.20 ± 0.06c	5.00 ± 0.91e	6.28 ± 0.07de	7.48 ± 0.04b	7.65 ± 0.05g
T4	2.85 ± 0.06a	3.21 ± 0.08b	3.20 ± 0.06c	5.80 ± 0.06abc	6.90 ± 0.03b	6.63 ± 0.05d	10.15 ± 0.12a
T5	2.85 ± 0.06a	3.21 ± 0.08b	3.20 ± 0.06c	6.28 ± 0.05a	6.43 ± 0.04cd	7.38 ± 0.04b	8.63 ± 0.07d
T6	2.65 ± 0.21a	4.38 ± 0.06a	4.80 ± 0.03a	6.23 ± 0.10ab	7.80 ± 0.11a	8.40 ± 0.04a	9.45 ± 0.04b
T7	2.65 ± 0.21a	4.38 ± 0.06a	4.80 ± 0.03a	5.90 ± 0.08abc	6.25 ± 0.02e	8.33 ± 0.11a	9.33 ± 0.08c
T8	2.65 ± 0.21a	4.38 ± 0.06a	4.80 ± 0.03a	5.70 ± 0.04bcd	6.45 ± 0.22c	5.28 ± 0.03e	7.70 ± 0.03g

Unit - mg/g FW

Table S7. Effect of water stress on soluble sugar content in grape berries

Treatments	Days after anthesis						
	40	60	70	90	100	110	120
CK	12.41 ± 0.38c	36.74 ± 1.58b	91.56 ± 6.41b	144.93 ± 3.45bc	160.52 ± 10.16cd	195.98 ± 8.70a	183.27 ± 6.55bc
T1	12.41 ± 0.38c	36.74 ± 1.58b	91.56 ± 6.41b	126.24 ± 4.75d	141.57 ± 3.56e	196.51 ± 7.48a	181.93 ± 13.66bcd
T2	12.41 ± 0.38c	36.74 ± 1.58b	91.56 ± 6.41b	133.75 ± 6.70cd	151.85 ± 1.04de	187.82 ± 14.14b	171.42 ± 5.70cd
T3	14.35 ± 0.80b	61.87 ± 8.09a	116.93 ± 8.47a	148.44 ± 5.69bc	161.76 ± 20.17abc	191.50 ± 5.63ab	170.66 ± 11.08d
T4	14.35 ± 0.80b	61.87 ± 8.09a	116.93 ± 8.47a	157.55 ± 3.00ab	184.37 ± 7.10a	200.45 ± 0.68a	199.56 ± 11.31a
T5	14.35 ± 0.80b	61.87 ± 8.09a	116.93 ± 8.47a	166.96 ± 11.51a	172.39 ± 12.28ab	196.40 ± 4.77ab	198.22 ± 7.20a
T6	19.97 ± 0.15a	21.29 ± 4.83c	99.18 ± 10.20b	148.37 ± 19.02cd	181.55 ± 9.40a	198.25 ± 14.10a	194.22 ± 13.12ab
T7	19.97 ± 0.15a	21.29 ± 4.83c	99.18 ± 10.20b	150.03 ± 14.79bc	160.90 ± 3.97cd	205.44 ± 6.35a	190.58 ± 10.67ab
T8	19.97 ± 0.15a	21.29 ± 4.83c	99.18 ± 10.20b	141.84 ± 6.70bc	163.18 ± 2.86bcd	191.23 ± 9.95ab	181.42 ± 15.34d

Unit - mg/g FW

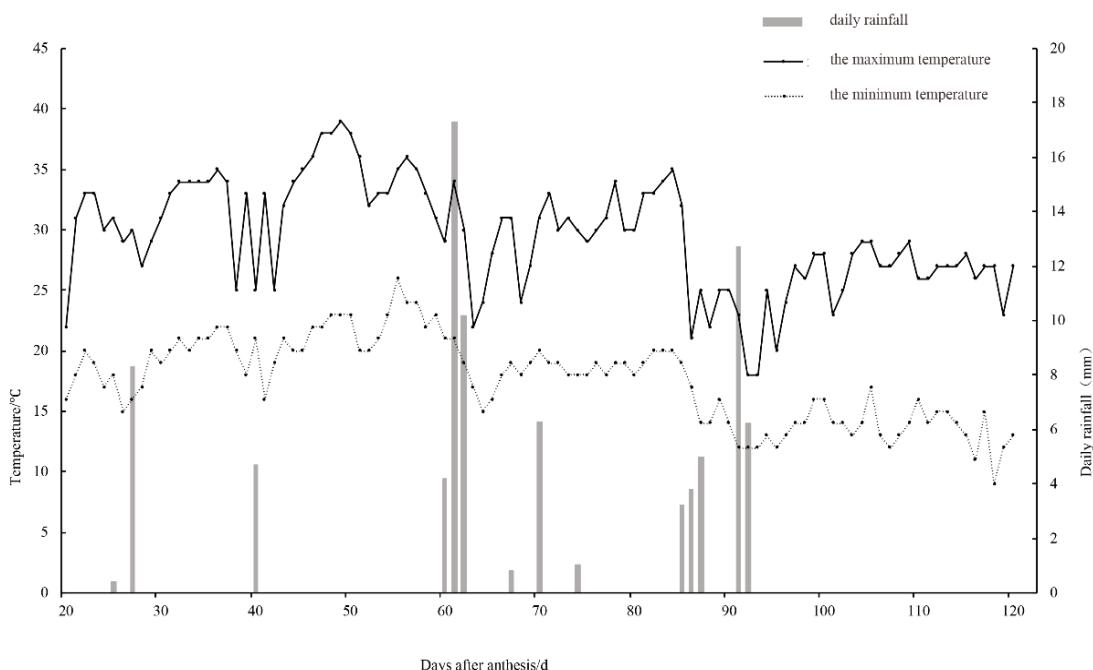
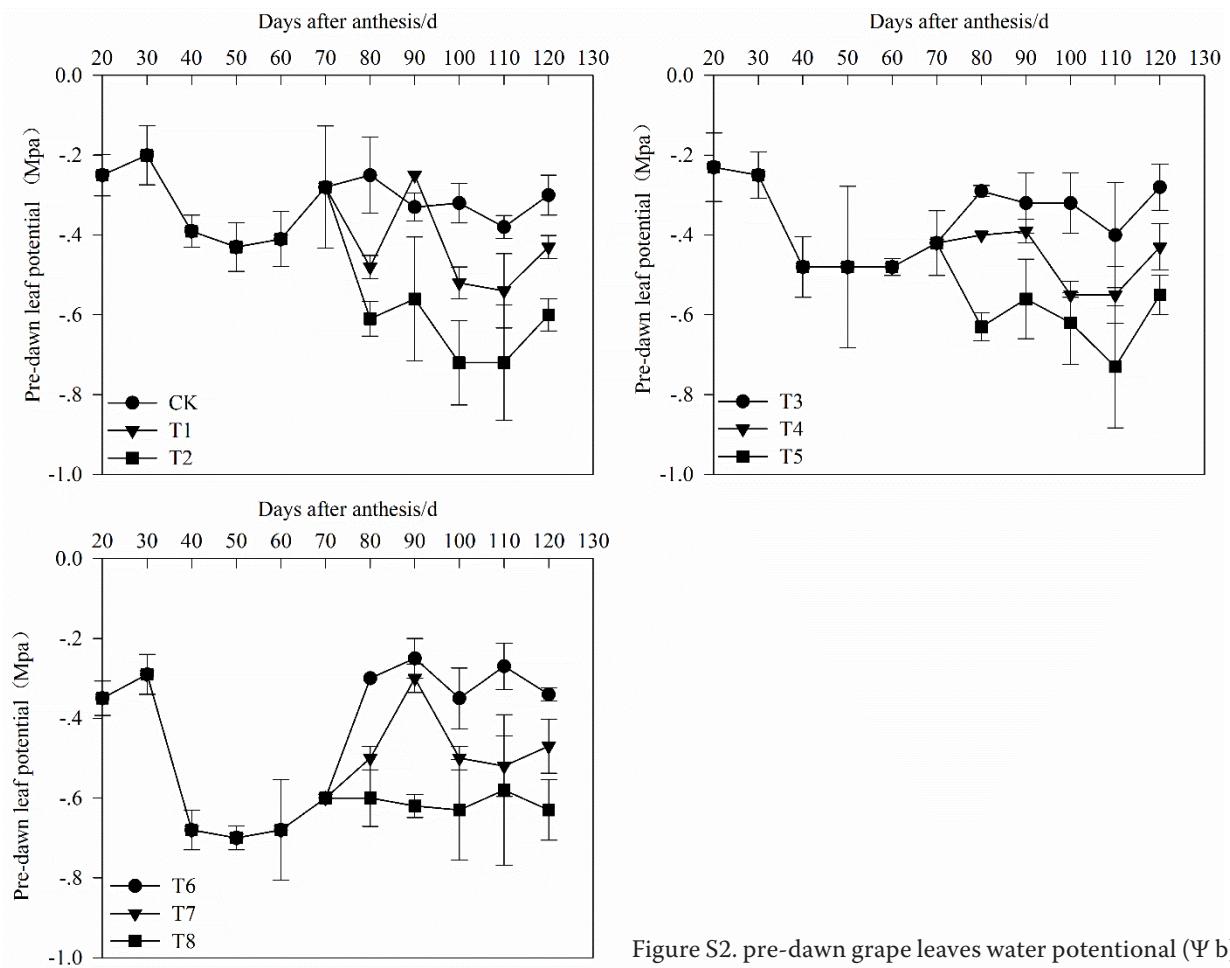


Figure S1. The rainfall and temperature during the test

Figure S2. pre-dawn grape leaves water potential (Ψ b)