SUPPLEMENTARY DATA
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Supplemental Material

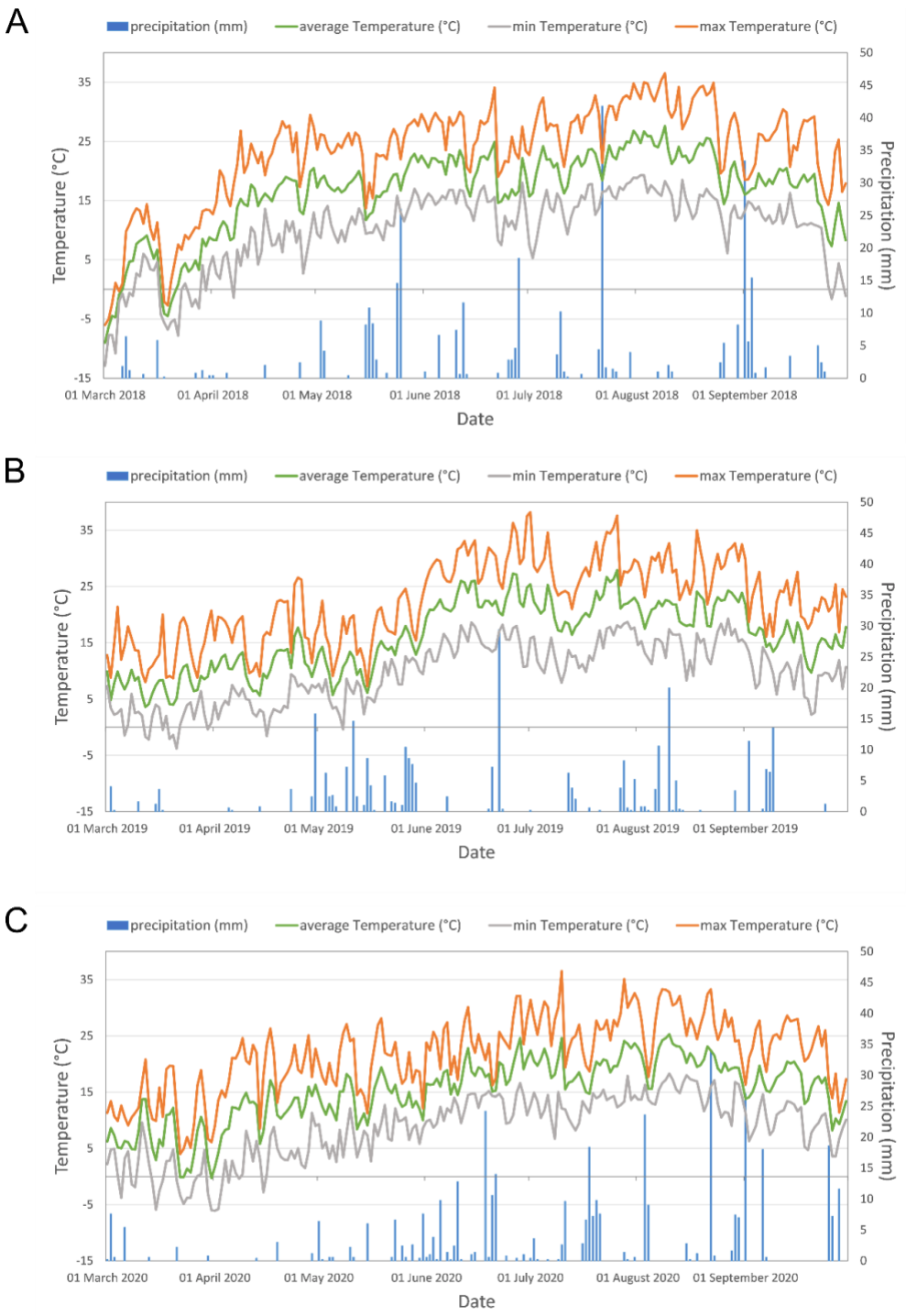


FIGURE S1. **Climatic conditions 2018–2020.** Summary of the daily air temperature (°C, minimal and maximal values, daily average) and the precipitation (mm) throughout the season. Values were obtained from a nearby weather station (ADCON, Kempten, Germany).

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FIGURE S2. **Treatment pictures 2019.** Sequence of pictures obtained in April, May and July 2019 for the five implemented treatments in the experimental vineyard. © Michaela Griesser

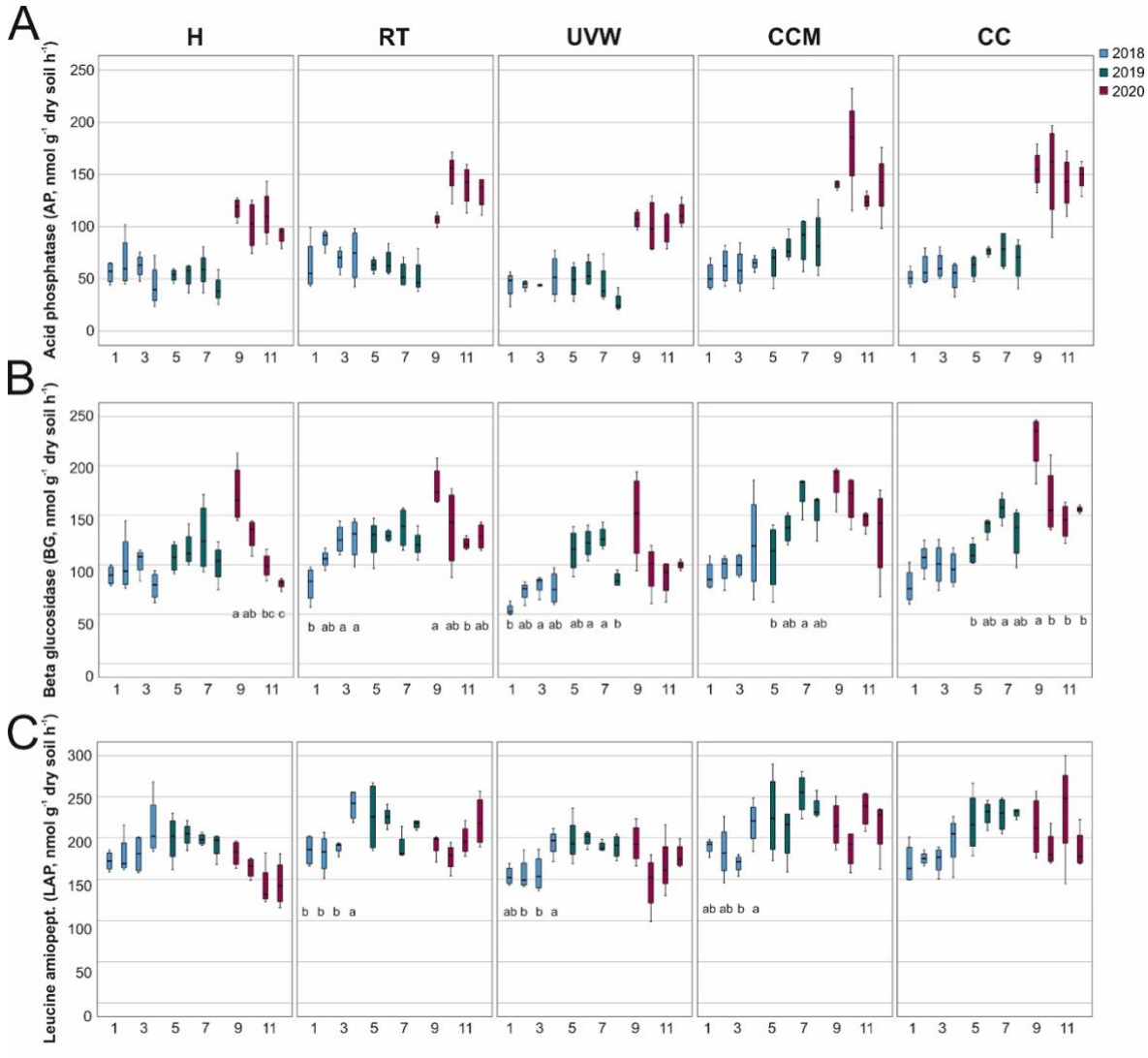


FIGURE S3. **Hydrolytic soil enzyme activity comparison for twelve sampling dates in three years.** Results of the soil enzyme activity measurement in 2018–2020 for the different under-vine treatments and sampling dates. A) Acid phosphatase (AP), B) β-glucosidase (BG) activity and C) Amino leucine peptidase (LAP). Data represent mean values of four replicates per treatment and sampling date. Different letters indicate differences between sampling timepoints for one treatment (One-Way ANOVA, Tukey test, $\alpha < 0.05$). Sampling dates: 1, 9th May 2018; 2, 16th June 2018; 3, 9th July 2018; 4, 25th July 2018; 5, 2nd May 2019; 6, 12th June 2019; 7, 26th June 2019; 8, 30th July 2019; 9, 6th April 2020; 10, 4th May 2020; 11, 3rd June 2020; 12, 30th July 2020. For simplification and readability, only every second date is shown on the x-axis.

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FIGURE S4. **Gravimetric soil water content at different sampling dates.** Results of the gravimetric soil water content obtained at different sampling dates in 2018–2020 for the different under-vine treatments. A) Gravimetric soil water content in 0–10 cm soil depth, B) gravimetric soil water content at 11–20 cm soil depth. Data represent mean values of four replicates per treatment and sampling date. Different letters indicate differences between sampling timepoints for one treatment (One-Way ANOVA, Tukey test, $\alpha < 0.05$).

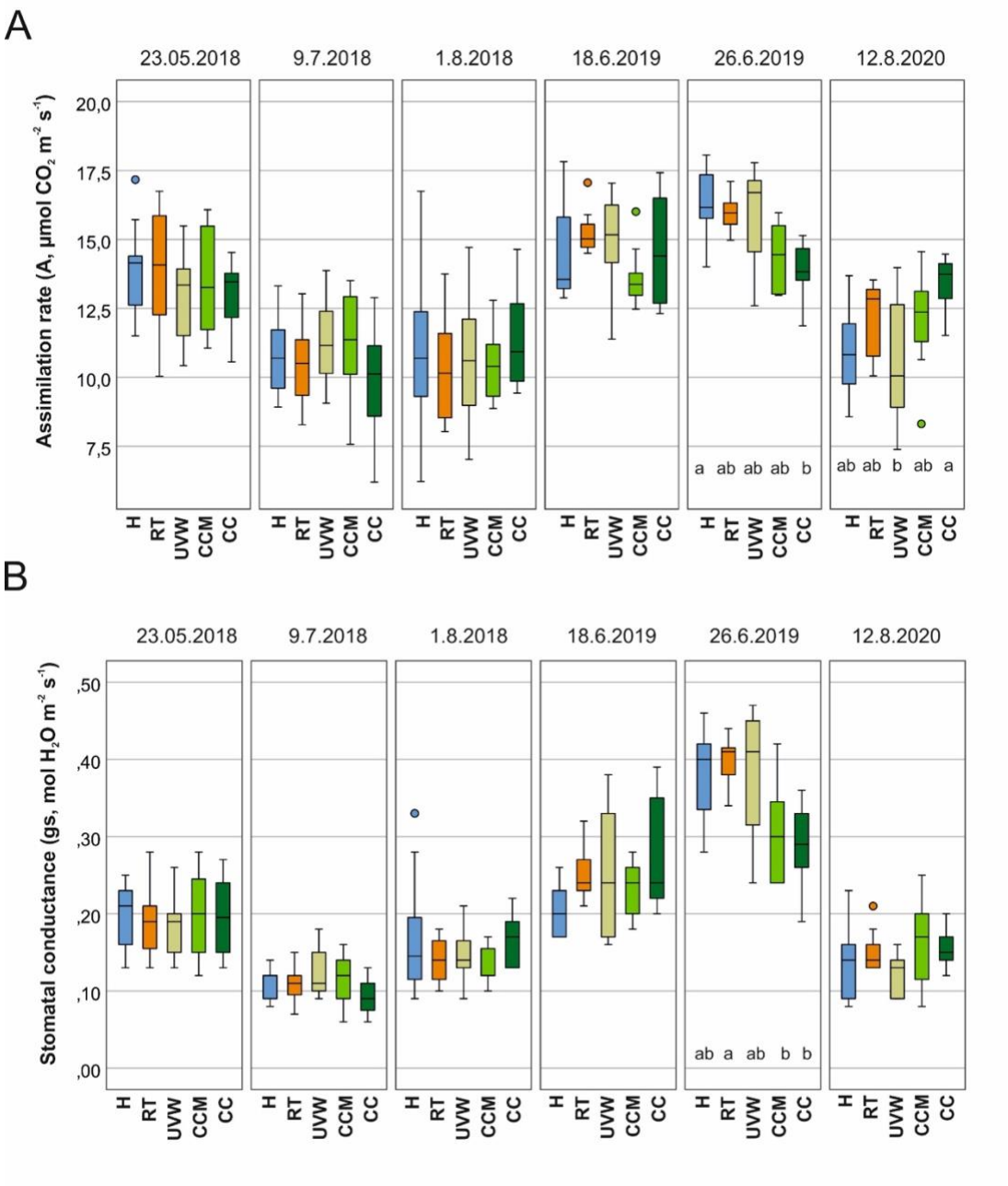


FIGURE S5. **Vine photosynthetic activity measured at different sampling dates.** Photosynthetic activity was measured at six time points during the study period 2018–2020. A) Assimilation rate, B) stomatal conductance. Boxplots were prepared on the basis of 12 measurements per treatment and sampling date. Different letters indicate differences between sampling timepoints for one treatment (One-Way ANOVA, Tukey test, $\alpha < 0.05$).

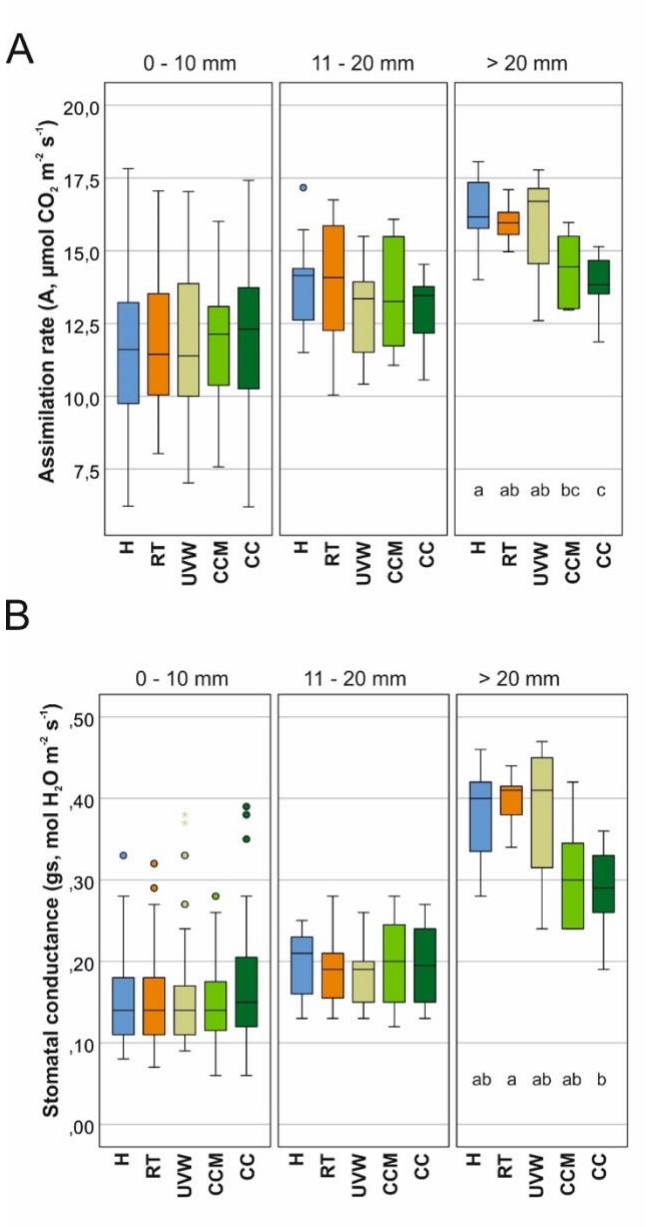


FIGURE S6. **Vine photosynthetic activity in relation to the precipitation 7 days prior to measurements.** A) Assimilation rate, B) stomatal conductance. Boxplots show results from measurement in relation to the under-vine treatments and the precipitation. Different letters indicate differences between sampling timepoints for one treatment (One-Way ANOVA, Tukey test, $\alpha < 0.05$).

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TABLE S1. Vineyard layout and experimental design. Vineyard with 25 vine rows and 120 vines per row divided into four blocks. Four repeats per treatment were established and kept the same from 2018–2020. Soil samples for soil enzyme activity and gravimetric soil water content measurements were taken from blocks A and B (green), while vine and fruit parameters were determined only from Pinot Noir clone 1-84 Gm (red) due to a growth depression of P.N clone 18Gm independent of the applied under-vine treatments.

Vine Row	Under-vine treatments - complete vine row	Block A vine 1-30	Block B vine 31-60	Block C vine 61-90	Block D vine 91-120
1	no treatment	18Gm	**1-84Gm**	1-84Gm	18Gm
2	no treatment				
3	no treatment				
4	no treatment				
5	Complete cover mowing (CCM) - 1				
6	Herbicide application (H) - 1	**1-84Gm**	18Gm	1-84Gm	18Gm
7	Rotary tillage (RT) - 1				
8	Complete cover NO mowing (CC) - 1				
9	Complete cover mowing (CCM) -2				
10	Under vine weeder (UVW) - 1				
11	Rotary tillage (RT) - 2	18Gm	18Gm	18Gm	1-84Gm
12	Under vine weeder (UVW) - 2				
13	Herbicide application (H) - 2				
14	Complete cover NO mowing (CC) - 2				
15	Complete cover mowing (CCM) -3				
16	Complete coverNO mowing (CC) - 3	**1-84Gm**	18Gm	1-84Gm	18Gm
17	Rotary tillage (RT) - 3				
18	Complete cover mowing (CCM) -4				
19	Under vine weeder (UVW) - 3				
20	Herbicide application (H) - 3				
21	Complete cover NO mowing (CC) - 4	1-84Gm	**1-84Gm**	18Gm	1-84Gm
22	Herbicide application (H) - 4				
23	Under vine weeder (UVW) - 4				
24	Rotary tillage (RT) - 4				
25	no treatment				

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TABLE S2. Dates of measures. Summary of treatments and dates of mesurements and collections of soil samples.

Year	Date	Dates of applied treatments & days after mechanical treatment (DAT)	Measurements & collection of samples
2018	03/05/2018	1. Herbicide application & mechanical tillage	
	09/05/2018	7 DAT	Soil samples for soil enzyme activity & gravimetric soil water content
	23/05/2018	20 DAT	Vine photosynthesis
	06/06/2018	2. Herbicide application & mechanical tillage	
	16/06/2018	10 DAT	Soil samples for soil enzyme activity & gravimetric soil water content
	03/07/2018	3. Herbicide application & mechanical tillage	
	09/07/2018	6 DAT	Soil samples for soil enzyme activity & gravimetric soil water content; vine photosysnthesis
	25/07/2018	22 DAT	Soil samples for soil enzyme activity & gravimetric soil water content
	01/08/2018	29 DAT	Vine photosynthesis
	27/08/2018	55 DAT	Soil samples for soil enzyme activity & gravimetric soil water content; collection of grape berries; yield estimation
2019	05.& 11.04.2019	1. Herbicide application & mechanical tillage	
	02/05/2019	21 DAT	Soil samples for soil enzyme activity & gravimetric soil water content
	05/06/2019	2. Mechanical tillage	
	12/06/2019	7 DAT	Soil samples for soil enzyme activity & gravimetric soil water content
	18/06/2019	13 DAT	Vine photosynthesis
	26/06/2019	20 DAT	Soil samples for soil enzyme activity & gravimetric soil water content; vine photosysnthesis
	02/07/2019	2. Herbicide application	
	22/07/2019	3. Mechanical tillage	
	30/07/2019	7 DAT	Soil samples for soil enzyme activity & gravimetric soil water content
	03. & 09.09.2019	48 DAT	Collection of grape berries; yield estimation
2020	06/04/2020		Soil samples for soil enzyme activity & gravimetric soil water content
	21. & 22.04.2020	1. Herbicide application & mechanical tillage	
	04/05/2020	10 DAT	Soil samples for soil enzyme activity & gravimetric soil water content
	03/06/2020	40 DAT	Soil samples for soil enzyme activity & gravimetric soil water content
	29/07/2020	2. Mechanical tillage	
	30/07/2020	1 DAT	Soil samples for soil enzyme activity & gravimetric soil water content; vine photosysnthesis
	10/08/2020	2. Herbicide application	
	12/08/2020	13 DAT	Vine photosynthesis
	25/08/2020	3. Mechanical tillage	
	17. & 22.09.2020		Soil samples for soil enzyme activity & gravimetric soil water content; collection of grape berries; yield estimation

TABLE S3. Detail results of the hydrolytic soil enzyme activity and gravimetric soil water content. Results represent the data obtained for soil enzyme activity and gravimetric soil water content (soil depths: 0–10 cm, 11–20 cm) at twelve dates during the study period from 2018–2020. All presented results are mean values ± standard deviations of N = 4 samples per treatment and collection date. Significant differences between treatments are indicated with different letters in bold (One-Way ANOVA, Tukey post-hoc test, $\alpha < 0.05$). Missing or not analysed samples are shown as not determined (n.d.).

Soil hydrolytic enzyme activity (nmol g^{-1} dry soil h^{-1})							
Year	**Treatment**	Sample collection date	**Acid phosphatase**	**β-glucosidase**	**Leucine amino peptidase**	**Gravimetric soil water content 0-10 cm (%)**	**Gravimetric soil water content 11-20 cm (%)**
2018	**herbicide (H)**	09/05/2018	56.1 ± 10.3	**89.6 ± 10.1 a**	172.3 ± 12.0	10.3 ± 1.4	**9.4 ± 0.4 ab**
	rotary tillage (RT)	09/05/2018	63.2 ± 25.4	**80.6 ± 18.2 ab**	185.2 ± 19.1	11.0 ± 2.8	**10.7 ± 2.2 a**
	under vine weeder (UVW)	09/05/2018	44.3 ± 14.4	**54.5 ± 6.1 b**	154.2 ± 11.7	8.8 ± 0.9	**8.6 ± 0.5 ab**
	complete cover mowing (CCM)	09/05/2018	52.4 ± 13.8	**89.1 ± 15.0 a**	189.8 ± 9.3	8.7 ± 1.7	**8.6 ± 0.4 ab**
	complete cover NO mowing (CC)	09/05/2018	51.2 ± 8.2	**78.6 ± 18.2 ab**	169.1 ± 24.8	7.5 ± 0.7	**7.7 ± 0.6 b**
	herbicide (H)	16/06/2018	**66.6 ± 25.4 ab**	102.0 ± 30.5	179.0 ± 24.9	10.0 ± 0.8	**8.8 ± 0.7 a**
	rotary tillage (RT)	16/06/2018	**88.6 ± 9.6 a**	106.0 ± 9.2	181.0 ± 23.9	9.7 ± 0.5	**8.0 ± 0.7 ab**
	under vine weeder (UVW)	16/06/2018	**44.5 ± 4.4 b**	73.4 ± 10.1	156.3 ± 20.1	10.1 ± 0.4	**8.7 ± 0.4 ab**
	complete cover mowing (CCM)	16/06/2018	**62.5 ± 17.6 ab**	96.3 ± 15.5	183.9 ± 33.4	9.2 ± 1.2	**7.5 ± 0.4 b**
	complete cover NO mowing (CC)	16/06/2018	**59.5 ± 15.4 ab**	106.4 ± 16.1	175.3 ± 8.1	9.6 ± 0.6	**7.9 ± 0.5 ab**
	herbicide (H)	09/07/2018	62.5 ± 11.6	**103.9 ± 13.9 ab**	180.4 ± 23.2	18.4 ± 2.5	n.d.
	rotary tillage (RT)	09/07/2018	68.8 ± 11.3	**126.1 ± 15.1 a**	187.5 ± 9	19.2 ± 2.2	n.d.
	under vine weeder (UVW)	09/07/2018	43.9 ± 1.4	**80.1 ± 10.1 b**	157.3 ± 22.5	20.9 ± 1.0	n.d.
	complete cover mowing (CCM)	09/07/2018	59.8 ± 19.4	**99.5 ± 11.5 ab**	169.2 ± 11.2	20.2 ± 1.9	n.d.
	complete cover NO mowing (CC)	09/07/2018	62.6 ± 13.4	**100.4 ± 22.1 ab**	173.3 ± 16.7	18.4 ± 2.6	n.d.
	herbicide (H)	25/07/2018	44.0 ± 20.9	78.9 ± 14.4	214.1 ± 38.0	19.8 ± 0.7	20.0 ± 0.9
	rotary tillage (RT)	25/07/2018	72.6 ± 25.9	126.9 ± 21.9	239.7 ± 18.6	18.4 ± 1.8	20.7 ± 0.5
	under vine weeder (UVW)	25/07/2018	52.2 ± 21.7	76.6 ± 17.2	194.3 ± 16.7	19.3 ± 0.6	20.5 ± 1.1
	complete cover mowing (CCM)	25/07/2018	64.8 ± 6.6	122.2 ± 51.2	218.4 ± 26.8	21.6 ± 4.1	20.0 ± 0.7
	complete cover NO mowing (CC)	25/07/2018	52.4 ± 14.5	96.6 ± 17.6	197.2 ± 31.7	21.4 ± 1.1	19.5 ± 0.7
2019	**herbicide (H)**	02/05/2019	53.4 ± 6.3	107.6 ± 15.3	199.1 ± 29.1	**20.7 ± 1.9 a**	**20.2 ± 2.5 a**
	rotary tillage (RT)	02/05/2019	63.3 ± 6.8	126.2 ± 21.5	225.8 ± 43.2	**18.9 ± 0.8 ab**	**18.4 ± 1.3 a**
	under vine weeder (UVW)	02/05/2019	48.1 ± 16.6	114.6 ± 22.3	197.9 ± 28.0	**18.3 ± 0.8 ab**	**18.9 ± 2.3 a**

	complete cover mowing (CCM)	02/05/2019	65.4 ± 17.7	107.7 ± 35.3	227.5 ± 51.5	**19.0 ± 0.8 ab**	**14.3 ± 0.2 b**
	complete cover NO mowing (CC)	02/05/2019	61.6 ± 11.2	111.9 ± 11.7	219.3 ± 37.9	**17.6 ± 1.2 b**	**14.6 ± 1.3 b**
	herbicide (H)	12/06/2019	**53.7 ± 12.2 b**	116.0 ± 18.1	204.1 ± 15.3	11.2 ± 0.4	**15.0 ± 0.6 a**
	rotary tillage (RT)	12/06/2019	**65.9 ± 13.1 ab**	129.5 ± 5.7	225.6 ± 12.4	10.6 ± 2.1	**12.1 ± 3.2 ab**
	under vine weeder (UVW)	12/06/2019	**55.9 ± 13.4 ab**	122.2 ± 15.3	199.7 ± 9.3	10.1 ± 0.6	**11.4 ± 1.3 ab**
	complete cover mowing (CCM)	12/06/2019	**79.7 ± 12.9 a**	137.0 ± 15.1	205.2 ± 33	8.0 ± 0.5	**8.9 ± 0.6 b**
	complete cover NO mowing (CC)	12/06/2019	**76.4 ± 4.1 ab**	138.6 ± 9.1	229.7 ± 15.6	8.0 ± 2.9	**9.0 ± 1.7 b**
	herbicide (H)	26/06/2019	**58.8 ± 18.1 ab**	128.0 ± 36.0	**198.7 ± 7.0 bc**	**15.7 ± 1.2 ab**	17.6 ± 0.5
	rotary tillage (RT)	26/06/2019	**54.5 ± 12.5 ab**	137.5 ± 21.0	**189.1 ± 16.9 c**	**13.0 ± 0.9 b**	14.7 ± 1.2
	under vine weeder (UVW)	26/06/2019	**45.3 ± 19.6 b**	127.8 ± 11.7	**189.6 ± 6.2 c**	**14.3 ± 1.4 ab**	15.3 ± 1.3
	complete cover mowing (CCM)	26/06/2019	**86.8 ± 23.0 a**	174.4 ± 19.3	**253.8 ± 24.7 a**	**16.4 ± 1.6 a**	16.9 ± 1.3
	complete cover NO mowing (CC)	26/06/2019	**77.6 ± 18.3 ab**	157.1 ± 13.7	**228.6 ± 21.0 ab**	**15.9 ± 1.7 ab**	15.8 ± 2.3
	herbicide (H)	30/07/2019	**40.3 ± 13.8 b**	**101.6 ± 20.2 bc**	**191.4 ± 16 bc**	**14.8 ± 0.6 ab**	**12.8 ± 1.5 ab**
	rotary tillage (RT)	30/07/2019	**52.5 ± 18.1 ab**	**121.3 ± 14.2 abc**	**216.8 ± 5.4 ab**	**11.9 ± 2.0 b**	**10.2 ± 1.1 b**
	under vine weeder (UVW)	30/07/2019	**27.7 ± 9.4 b**	**85.2 ± 7.3 c**	**189.9 ± 14.6 c**	**15.2 ± 1.8 ab**	**13.9 ± 1.5 a**
	complete cover mowing (CCM)	30/07/2019	**85.7 ± 31.2 a**	**155.4 ± 20.8 a**	**236.5 ± 14.2 a**	**17.4 ± 2.6 a**	**13.9 ± 2.1 a**
	complete cover NO mowing (CC)	30/07/2019	**67.4 ± 20.1 ab**	**132.3 ± 26.5 ab**	**230.5 ± 5.7 a**	**16.1 ± 2 ab**	**14.6 ± 2.8 a**
2020	**herbicide (H)**	06/04/2020	**117.4 ± 10.7 bc**	172.1 ± 31.0 ab	181.5 ± 16.0	**9.8 ± 1.9 ab**	**12.5 ± 1.0 a**
	rotary tillage (RT)	06/04/2020	**106.8 ± 7.2 c**	179.5 ± 20.6 ab	190.4 ± 16.9	**8.5 ± 0.2 b**	**9.0 ± 1.4 b**
	under vine weeder (UVW)	06/04/2020	**106.8 ± 8.7 c**	148.1 ± 45.2 b	193.7 ± 24.5	**9.9 ± 1.1 ab**	**11.2 ± 0.4 a**
	complete cover mowing (CCM)	06/04/2020	**140.4 ± 4 ab**	184.5 ± 20.7 ab	216.5 ± 28.6	**9.5 ± 0.2 ab**	**12.0 ± 0.9 a**
	complete cover NO mowing (CC)	06/04/2020	**155.3 ± 19.1 a**	224.9 ± 29.7 a	213.9 ± 37.7	**11.0 ± 0.6 a**	**13.2 ± 0.9 a**
	herbicide (H)	04/05/2020	101.5 ± 23.7	**131.2 ± 16.3 ab**	n.d.	9.5 ± 0.7	9.4 ± 0.6
	rotary tillage (RT)	04/05/2020	149.8 ± 25.2	**137.4 ± 41.2 ab**	n.d.	8.5 ± 1.8	8.1 ± 1.5
	under vine weeder (UVW)	04/05/2020	101.0 ± 26.3	**100.8 ± 16.4 b**	n.d.	9.5 ± 0.8	9.3 ± 0.4
	complete cover mowing (CCM)	04/05/2020	179.9 ± 48.6	**166.7 ± 23.7 a**	n.d.	9.4 ± 0.3	8.3 ± 0.6
	complete cover NO mowing (CC)	04/05/2020	152.9 ± 47.8	**164.3 ± 34.6 a**	n.d.	9.0 ± 1.0	8.8 ± 0.8
	herbicide (H)	03/06/2020	111.6 ± 25.0	**131.2 ± 16.3 ab**	**142.1 ± 27.1 b**	10.8 ± 0.4	9.4 ± 0.4
	rotary tillage (RT)	03/06/2020	139.7 ± 20.3	**137.4 ± 41.2 ab**	**197.5 ± 18.4 ab**	9.9 ± 0.5	8.9 ± 1.4
	under vine weeder (UVW)	03/06/2020	98.7 ± 16.2	**95.8 ± 25.1 b**	**167.1 ± 35.9 ab**	10.0 ± 0.9	8.9 ± 0.6
	complete cover mowing (CCM)	03/06/2020	124.5 ± 7.3	**166.7 ± 23.7 a**	**235.1 ± 22.3 a**	9.5 ± 1.0	8.1 ± 1.2

	complete cover NO mowing (CC)	03/06/2020	142.3 ± 26.4	**164.3 ± 34.6 a**	**235.0 ± 65.3 a**	9.2 ± 1.2	7.9 ± 1.1
	herbicide (H)	30/07/2020	**104.0 ± 28.6 b**	**99.5 ± 38.1 b**	**171.6 ± 50.6 ab**	n.d.	n.d.
	rotary tillage (RT)	30/07/2020	**121.1 ± 20.9 a**	**114.6 ± 21.2 ab**	**194.1 ± 51.7 ab**	n.d.	n.d.
	under vine weeder (UVW)	30/07/2020	**112.3 ± 12.1 ab**	**99.8 ± 5.9 b**	**178.2 ± 15.4 ab**	n.d.	n.d.
	complete cover mowing (CCM)	30/07/2020	**140.0 ± 31.9 a**	**132.1 ± 47.4 ab**	**213.4 ± 34.3 a**	n.d.	n.d.
	complete cover NO mowing (CC)	30/07/2020	**148.1 ± 14 a**	**156.1 ± 4.5 a**	**186.7 ± 24.8 ab**	n.d.	n.d.

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TABLE S4. Linear mixed regression model. Summary of coefficients obtained from general linear models for acid phosphatase (AP), beta-glucosidase (BG) and leucine aminopeptidase (LAP) as response variables fitted by restricted maximum likelihood (REML). The mixed model included the random factor (1|year/sampling dates) and analysed the fixed factor treatment and the continuous variables soil water content 0–10 cm soil depth and soil water content 11–20 cm soil depth. Significances were obtained by t-test using Satterthwaite's method.

	Acid phosphatase (AP, log scale)			**β-glucosidase (BG)**			**Leucine aminopeptidase (LAP)**		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	4,1	3.5 – 4.7	< **0.001**	78,1	35.2 – 120.9	< **0.001**	147,0	124.3 – 169.7	< **0.001**
group [RT]	0,2	0.1 – 0.4	< **0.001**	17,9	7.5 – 28.2	**0,001**	22,4	10.6 – 34.2	< **0.001**
group [UVW]	-0,1	-0.3 – -0.02	**0,027**	-11,8	-21.9 – -1.7	**0,023**	-3,4	-15.0 – 8.2	0,565
group [CCM]	0,3	0.2 – 0.4	< **0.001**	30,2	19.2 – 40.8	< **0.001**	35,7	23.7 – 47.6	< **0.001**
group [CC]	0,2	0.1 – 0.4	< **0.001**	27,5	17.0 – 37.9	< **0.001**	28,6	16.8 – 40.4	< **0.001**
GravWC10	0,0	-0.02 – 0.04	0,428	-0,5	-2.9 – 1.8	0,654	-0,3	-2.6 – 2.0	0,81
GravWC20	0,0	-0.03 – 0.02	0,926	3,1	0.8 – 5.4	**0,01**	3,0	0.7 – 5.3	**0,011**
Random Effects									
σ^2	0,07			525,74			694,33		
τ_{00}	0.01 datecode:year			353.63 datecode:year			49.57 datecode:year		
	0.23 year			821.31 year			81.74 year		
ICC	0,76			0,69			0,16		
N	10 datecode			10 datecode			10 datecode		
	3 year			3 year			3 year		
Observations	198			200			199		
Marginal R^2 / Conditional R^2	0.084 / 0.783			0.168 / 0.743			0.290 / 0.403		

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TABLE S5A. Influencing factors on gravimetric soil. Summary of coefficients obtained from linear mixed models fitted by restriction maximum likelihood (REML) for the response variables: gravimetric soil water content in 0–10 cm soil depth (GravWC10); and gravimetric soil water content in 11–20 cm soil depth (GravWC20). Mixed models included the random factor (1| sampling data) and analysed the fixed factors under-vine treatments as well as the precipitation 14 days prior to the soil sampling as a categorical variable with three levels (1: 0–10 mm, 2: 11–20 mm, 3: > 20 mm). Significances were obtained by t-test using Satterthwaite's method.

	GravWC10			**GravWC20**		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	6,84	3.92 – 9.76	**< 0.001**	9,52	5.57 – 13.47	**< 0.001**
group [RT]	-1,04	-1.75 – -0.33	**0,004**	-1,46	-2.47 – -0.45	**0,005**
group [UVW]	-0,41	-1.17 – 0.34	0,283	-0,86	-1.72 – 0.01	0,052
group [CCM]	-0,19	-1.24 – 0.85	0,715	-1,68	-3.17 – -0.18	**0,028**
group [CC]	-0,66	-1.71 – 0.39	0,215	-1,63	-3.16 – -0.09	**0,038**
rain2_code 14d	3,03	1.05 – 5.01	**0,003**	1,82	-0.64 – 4.29	0,147
Random Effects						
σ^2		2,89			2,89	
$\tau_{00\ datecode}$		11,7			16,18	
ICC		0,8			0,85	
$N_{datecode}$		11			10	
Observations		220			200	
Marginal R^2 / Conditional R^2		0.324 / 0.866			0.134 / 0.869	
AIC		922,274			833,695	

SUPPLEMENTARY DATA
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Table S5b. Influencing factors on gravimetric soil. Summary of coefficients obtained from linear mixed models fitted by restriction maximum likelihood (REML) for the response variables: gravimetric soil water content in 0–10 cm soil depth (GravWC10); and gravimetric soil water content in 11–20 cm soil depth (GravWC20). Mixed models included the random factor (1| sampling data) and analysed the fixed factors under-vine treatments as well as the precipitation 7 days prior to the soil sampling as a categorical variable with three levels (1: 0–10 mm, 2: 11–20 mm, 3: > 20 mm). Significances were obtained by t-test using Satterthwaite's method.

	GravWC10			**GravWC20**		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	10,89	4.11 – 17.67	**0,002**	9,28	4.09 – 14.47	**0,001**
group [RT]	-1,04	-1.75 – -0.33	**0,004**	-1,46	-2.47 – -0.45	**0,005**
group [UVW]	-0,41	-1.17 – 0.34	0,283	-0,86	-1.72 – 0.01	0,052
group [CCM]	-0,19	-1.24 – 0.85	0,715	-1,68	-3.17 – -0.18	**0,028**
group [CC]	-0,66	-1.71 – 0.39	0,215	-1,63	-3.16 – -0.09	**0,038**
rain1_code 7d	1,49	-1.87 – 4.85	0,384	2,12	-0.95 – 5.20	0,175
Random Effects						
σ^2		2,89			2,83	
$\tau_{00\ datecode}$		17,15			12,73	
ICC		0,86			0,82	
$N_{\ datecode}$		11			10	
Observations		220			200	
Marginal R^2 / Conditional R^2		0.071 / 0.866			0.167 / 0.849	
AIC		926,437			836,661	

SUPPLEMENTARY DATA
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TABLE S6. The photosynthetic activity of vines was measured at five time points during the study period from 2018–2020. All presented results are mean values ± standard deviations (N = 8 per treatment and time point). Statistical analyses were performed as One-Way ANOVA followed by a Tukey post-hoc test to determine treatment effects on obtained data within each sampling date. Significant differences between treatments on the level $\alpha < 0.05$ are indicated with different letters in bold.

Treatment	Date	Transpiration rate E (mmol H_2O m^{-2} s^{-1})	Stomatal conductance gs (mmol CO_2 m^{-2} s^{-1})	Assimilation rate A (µmol CO_2 m^{-2} s^{-1})
herbicide (H)	23/05/2018	3.10 ± 0.36	0.20 ± 0.04	13.81 ± 1.66
rotary tillage (RT)	23/05/2018	2.79 ± 0.37	0.19 ± 0.05	13.90 ± 2.38
under vine weeder (UVW)	23/05/2018	2.80 ± 0.33	0.18 ± 0.04	13.07 ± 1.71
complete cover mowing (CCM)	23/05/2018	2.69 ± 0.36	0.20 ± 0.06	13.50 ± 1.97
complete cover NO mowing (CC)	23/05/2018	3.04 ± 0.38	0.20 ± 0.05	12.93 ± 1.29
herbicide (H)	09/07/2018	**2.25 ± 0.38 ab**	0.11 ± 0.02	10.69 ± 1.41
rotary tillage (RT)	09/07/2018	**2.08 ± 0.34 b**	0.11 ± 0.02	10.44 ± 1.53
under vine weeder (UVW)	09/07/2018	**2.53 ± 0.42 a**	0.12 ± 0.03	11.28 ± 1.48
complete cover mowing (CCM)	09/07/2018	**2.19 ± 0.36 ab**	0.12 ± 0.03	11.16 ± 1.94
complete cover NO mowing (CC)	09/07/2018	**1.90 ± 0.48 b**	0.09 ± 0.02	9.76 ± 2.02
herbicide (H)	01/08/2018	3.96 ± 0.71	0.17 ± 0.08	10.82 ± 2.87
rotary tillage (RT)	01/08/2018	3.61 ± 0.56	0.14 ± 0.03	10.24 ± 1.89
under vine weeder (UVW)	01/08/2018	3.89 ± 0.55	0.15 ± 0.04	10.67 ± 2.37
complete cover mowing (CCM)	01/08/2018	3.73 ± 0.91	0.13 ± 0.03	10.50 ± 1.37
complete cover NO mowing (CC)	01/08/2018	4.11 ± 0.27	0.17 ± 0.03	11.44 ± 1.8
herbicide (H)	18/06/2019	2.99 ± 0.33	0.21 ± 0.04	14.53 ± 1.9
rotary tillage (RT)	18/06/2019	2.95 ± 0.15	0.25 ± 0.04	15.27 ± 0.81
under vine weeder (UVW)	18/06/2019	3.21 ± 0.79	0.25 ± 0.09	14.75 ± 1.95
complete cover mowing (CCM)	18/06/2019	3.11 ± 0.3	0.23 ± 0.04	13.65 ± 1.12
complete cover NO mowing (CC)	18/06/2019	2.95 ± 0.27	0.28 ± 0.08	14.52 ± 1.99
herbicide (H)	26/06/2019	4.73 ± 0.68	**0.38 ± 0.07 ab**	**16.33 ± 1.28 a**
rotary tillage (RT)	26/06/2019	4.75 ± 0.98	**0.41 ± 0.05 a**	**15.97 ± 0.7 ab**
under vine weeder (UVW)	26/06/2019	4.64 ± 0.55	**0.38 ± 0.09 ab**	**15.78 ± 1.95 ab**
complete cover mowing (CCM)	26/06/2019	4.86 ± 0.51	**0.30 ± 0.07 b**	**14.36 ± 1.24 ab**
complete cover NO mowing (CC)	26/06/2019	4.44 ± 0.53	**0.29 ± 0.06 b**	**13.74 ± 1.14 b**
herbicide (H)	12/08/2020	3.32 ± 0.89	0.14 ± 0.05	**11.07 ± 1.66 ab**
rotary tillage (RT)	12/08/2020	3.63 ± 0.5	0.15 ± 0.03	**12.25 ± 1.35 ab**
under vine weeder (UVW)	12/08/2020	3.15 ± 0.39	0.12 ± 0.03	**10.66 ± 2.55 b**
complete cover mowing (CCM)	12/08/2020	3.12 ± 0.62	0.16 ± 0.06	**12.06 ± 1.88 ab**
complete cover NO mowing (CC)	12/08/2020	3.63 ± 0.56	0.16 ± 0.03	**13.43 ± 1.06 a**

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TABLE S7. Linear mixed regression model. Summary of coefficients obtained from linear regression analyses to determine the relationship between assimilation rate (A) and the stomatal conductance (gs) with the precipitation in the weak (7d) ahead of the sample collection and the sampling date as a random factor. Precipitation was included as categorical variables with three levels (1: 0–10 mm, 2: 11–20 mm, 3: > 20 mm). Significances were obtained by t-test using Satterthwaite's method.

	A, assimilation rate			**log(gs), stomatal conducatance**		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	9,56	6.65 – 12.47	**< 0.001**	-2,38	-2.92 – -1.84	**< 0.001**
group [RT]	0,45	-1.02 – 1.92	0,548	0,02	-0.19 – 0.23	0,88
group [UVW]	0,47	-1.01 – 1.94	0,535	0,04	-0.17 – 0.26	0,676
group [CCM]	1,09	-0.35 – 2.53	0,138	0,14	-0.06 – 0.35	0,169
group [CC]	1,82	0.36 – 3.27	**0,014**	0,22	0.01 – 0.42	**0,042**
code_rain1	2,22	0.48 – 3.96	**0,012**	0,44	0.12 – 0.76	**0,007**
group [RT] * code_rain1	-0,24	-1.17 – 0.68	0,606	0,01	-0.12 – 0.14	0,887
group [UVW] * code_rain1	-0,42	-1.34 – 0.51	0,376	-0,03	-0.17 – 0.10	0,616
group [CCM] * code_rain1	-0,92	-1.82 – -0.02	**0,044**	-0,11	-0.24 – 0.02	0,089
group [CC] * code_rain1	-1,43	-2.32 – -0.55	**0,002**	-0,15	-0.28 – -0.02	**0,021**
Random Effects						
σ^2		3,25			0,07	
$\tau_{00\ date}$		2,38			0,09	
ICC		0,42			0,56	
$N_{\ date}$		6			6	
Observations		296			296	
Marginal R^2 / Conditional R^2		0.204 / 0.541			0.332 / 0.709	

SUPPLEMENTARY DATA
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TABLE S8. Results of grape quality parameters (berry weight, total soluble solids, total titratable acidity, yeast assimilable nitrogen) and vine vitality-related parameters (cluster weight, yield, pruning weight) determined in 2018–2020 are presented as mean values with standard deviations. Differences between treatments were determined with One-Way ANOVA on the level $\alpha < 0.05$ followed by a Tukey post-hoc test. Different letters indicate significant differences. * pruning weight was determined in 2020 on pre-cuted shoots, weight represents a shoot length of 50 cm.

Year	Treatment	Berry weight (g)	Total soluble solids (°Brix)	Titratable acid (g L^{-1})	NOPA	Cluster weight (g)	Yield per vine (kg)	Pruning weight* (g)
2018	**herbicide (H)**	1.2 ± 0.2	18.0 ± 0.8	6.4 ± 0.7				
	rotary tillage (RT)	1.3 ± 0.15	18.7 ± 0.5	7.1 ± 0.4				
	under vine weeder (UVW)	1.1 ± 0.1	18.9 ± 0.7	7.2 ± 0.4				
	complete cover mowing (CCM)	1.1 ± 0.1	17.8 ± 0.5	7.2 ± 0.6				
	complete cover NO mowing (CC)	1.0 ± 0.1	18.3 ± 0.8	6.5 ± 1.1				
2019	**herbicide (H)**	**1.7 ± 0.1 a**	17.9 ± 0.2	10.9 ± 0.2		165.0 ± 31.8	5.6 ± 1.3	411.3 ± 147.6
	rotary tillage (RT)	**1.7 ± 0.1 a**	18.2 ± 0.8	10.8 ± 0.2		186.2 ± 36.6	5.6 ± 1.4	400.2 ± 148.3
	under vine weeder (UVW)	**1.6 ± 0.1 ab**	18.0 ± 0.2	10.5 ± 0.3		181.4 ± 27.9	6.0 ± 1.1	451.0 ± 165.6
	complete cover mowing (CCM)	**1.6 ± 0.1 ab**	17.5 ± 0.3	11.0 ± 0.1		176.1 ± 45.9	5.9 ± 1.2	353.1 ± 122.3
	complete cover NO mowing (CC)	**1.4 ± 0.0 b**	17.5 ± 0.7	10.9 ± 0.2		174.1 ± 26.0	5.5 ± 1.0	358.4 ± 99.7
2020	**herbicide (H)**	1.7 ± 0.1	18.3 ± 0.5	10.4 ± 0.4	85.3 ± 14.6	147.3 ± 29.2	2.5 ± 1.1	**141.5 ± 11.1 a**
	rotary tillage (RT)	1.9 ± 0.1	18.2 ± 0.2	10.2 ± 0.2	74.7 ± 10.9	150.0 ± 28.5	3.0 ± 1.1	**128.1 ± 16.2 ab**
	under vine weeder (UVW)	1.7 ± 0.2	17.9 ± 0.4	10.2 ± 0.2	72.1 ± 10.8	147.8 ± 21.5	3.3 ± 1.2	**118.5 ± 10.5 b**
	complete cover mowing (CCM)	1.7 ± 0.3	18.3 ± 0.3	9.9 ± 0.2	76.0 ± 20.1	142.5 ± 24.9	3.1 ± 1.1	**118.8 ± 17 b**
	complete cover NO mowing (CC)	1.6 ± 0.1	18.1 ± 0.2	9.9 ± 0.3	68.2 ± 6.1	162.3 ± 29.3	3.2 ± 1.3	**118.3 ± 10.4 b**