SUPPLEMENTARY DATA
Friedel, M., Rauhut, D., Heilemann, K.-K., Keller, M., Fritsch, S., Hofmann, M., & Stoll, M. (2026). Water deficit and leaf removal have interacting effects on the terpenoid composition of 'Riesling' grapes. *OENO One, 60*(4).
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SUPPLEMENTARY DATA

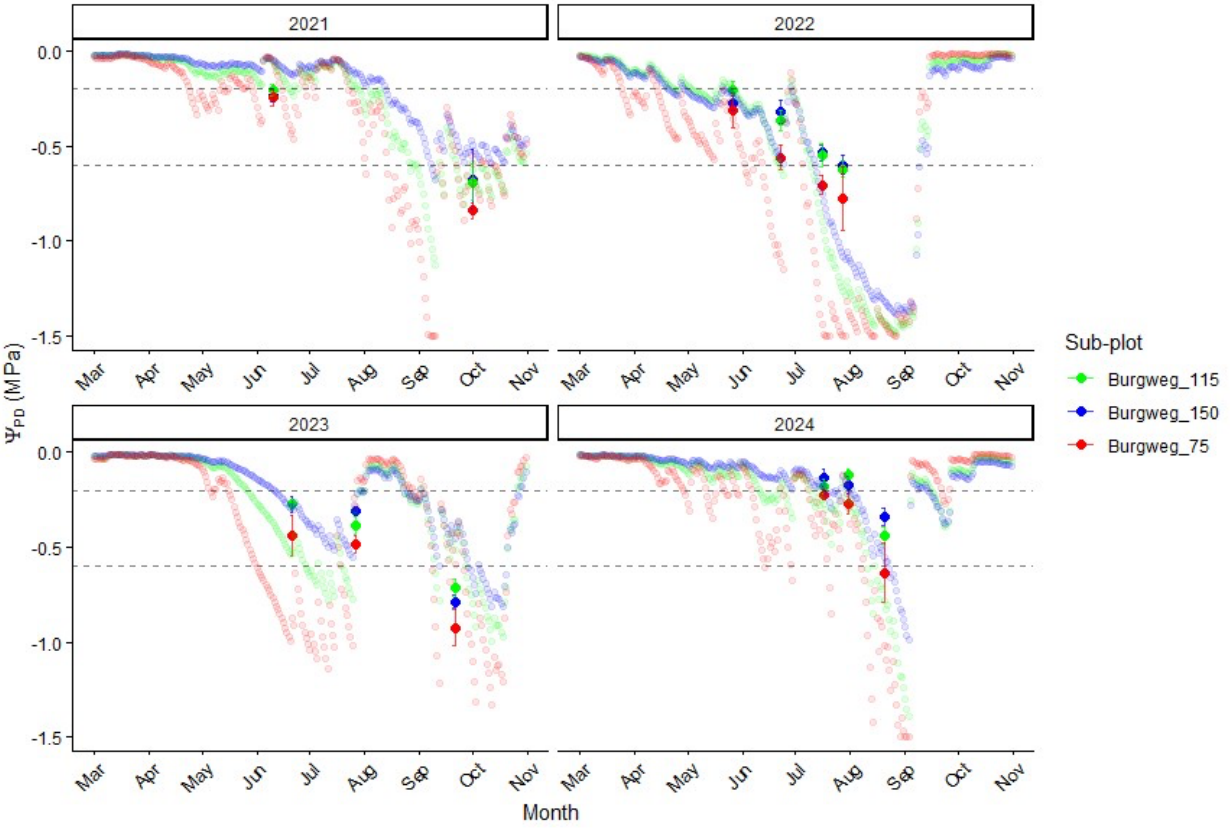


Figure S1. Simulated (open circles) and measured (filled circles) Ψ_{PD} in unirrigated grapevines of three sub-plots of the experimental vineyard in Rüdesheimer Berg Schlossberg Burgweg with differing AWC of the effective rooting zone (75, 115, 150 mm), growing season 2021–2024. Dashed lines indicated treshold for moderate and severe water stress (Deloire *et al.*, 2004).

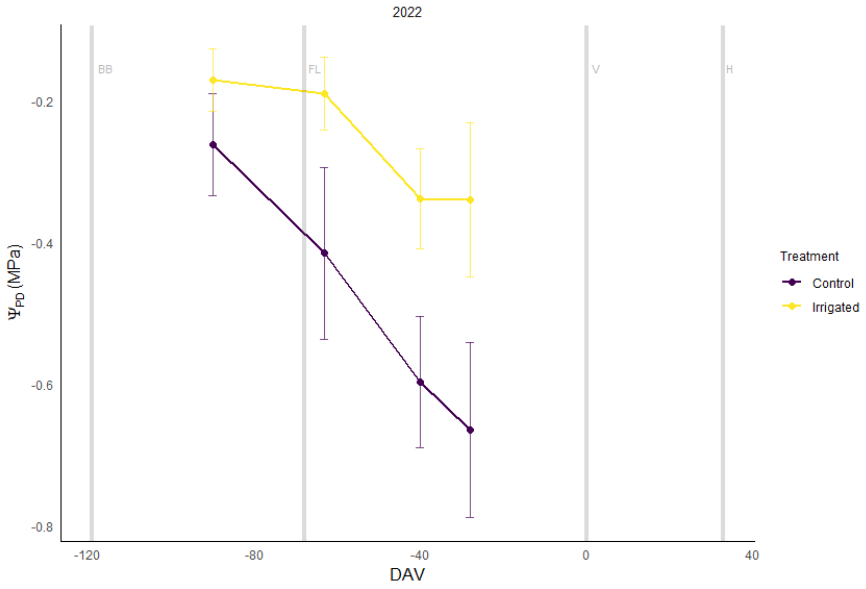


Figure S2. Evolution of pre-dawn water potential in an irrigation trial (Experiment 1a) in a drought-stress susceptible Riesling vineyard near Rüdesheim, Germany during the 2022 growing season. Values are means, error bars represent standard deviations (4 leaves per block × treatment combination).

Friedel, M., Rauhut, D., Heilemann, K.-K., Keller, M., Fritsch, S., Hofmann, M., & Stoll, M. (2026). Water deficit and leaf removal have interacting effects on the terpenoid composition of 'Riesling' grapes. *OENO One, 60*(4).
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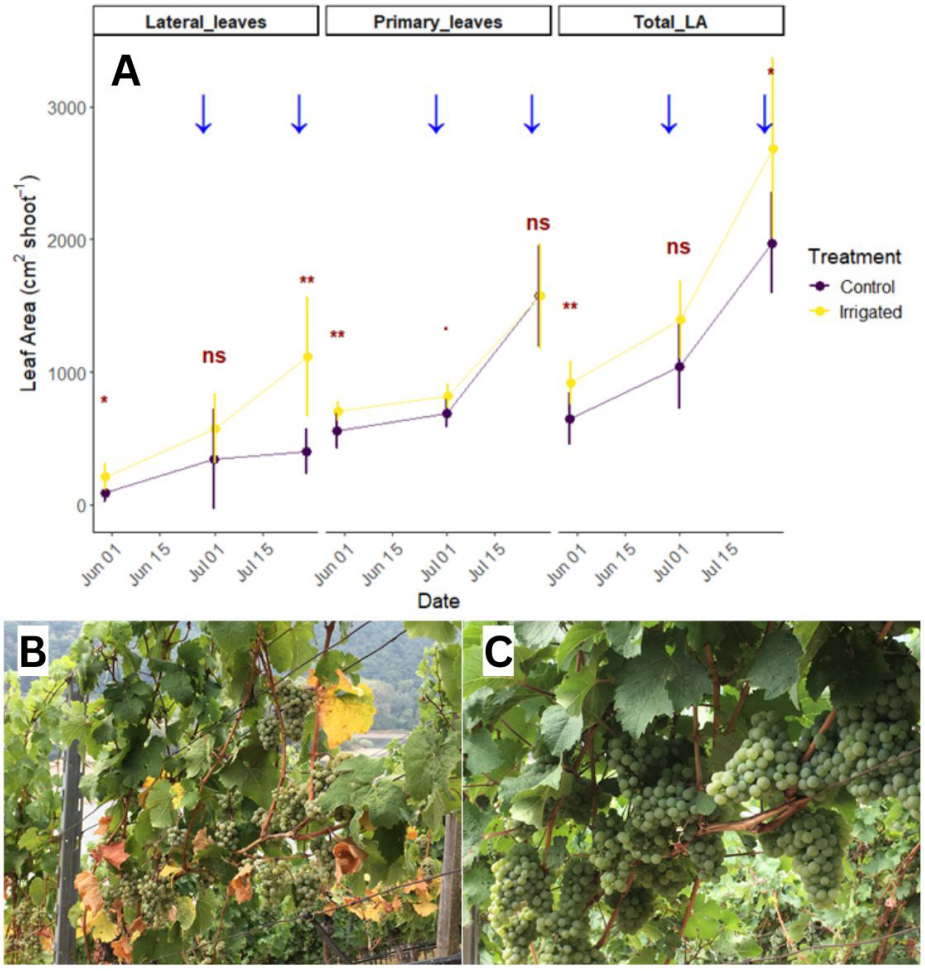


Figure S3. A) Development of lateral, primary and total leaf area per shoot in irrigated and control grapevines as determined by 3D digitisation. Arrows indicate trimming. Data from a trial conducted in Rüdesheim, Germany, in 2022 (Experiment 1a). "." indicates $0.1 > p > 0.05$, "*" indicates $0.05 > p > 0.01$, "**" indicates $0.01 > p > 0.001$, "***" indicates $0.001 > p$, as determined by two-factorial ANOVA (block, treatment). B and C) Comparison of unirrigated (B) with irrigated control vines (C) during an irrigation trial (Experiment 1a) in a drought-stress susceptible Riesling vineyard near Rüdesheim, Germany on 18 August 2022.

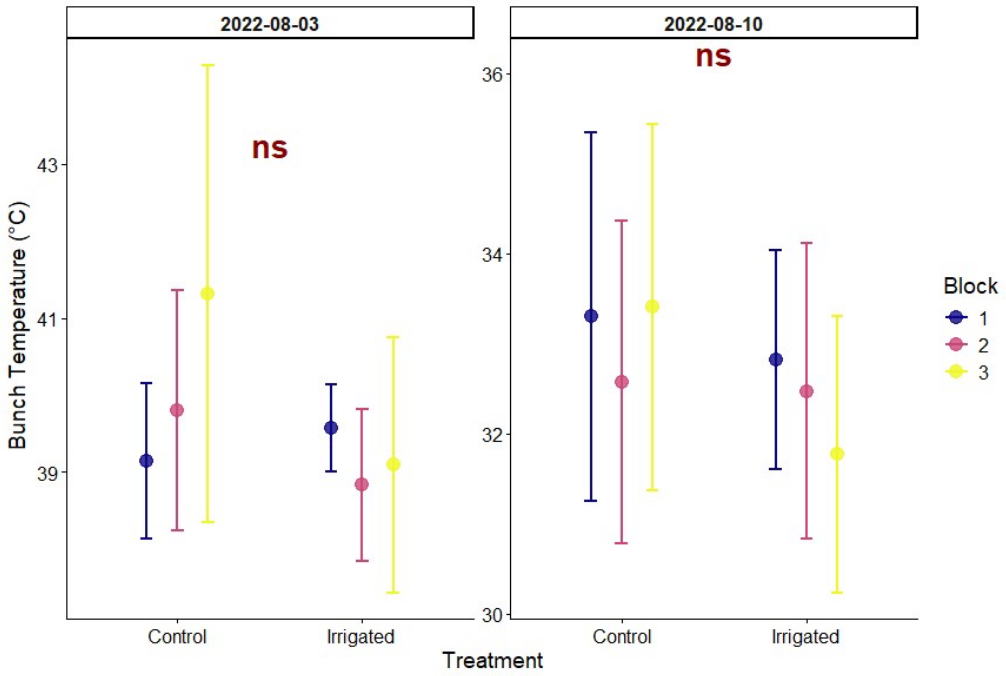


Figure S4. Bunch temperatures measured by infrared thermography at midday (14 :30 and 12:30, respectively) during two hot days (03.08.2022 : Tmax = 36.9° C ; 10.08.2022 : Tmax 32.3° C) around veraison 2022 (n = 3).

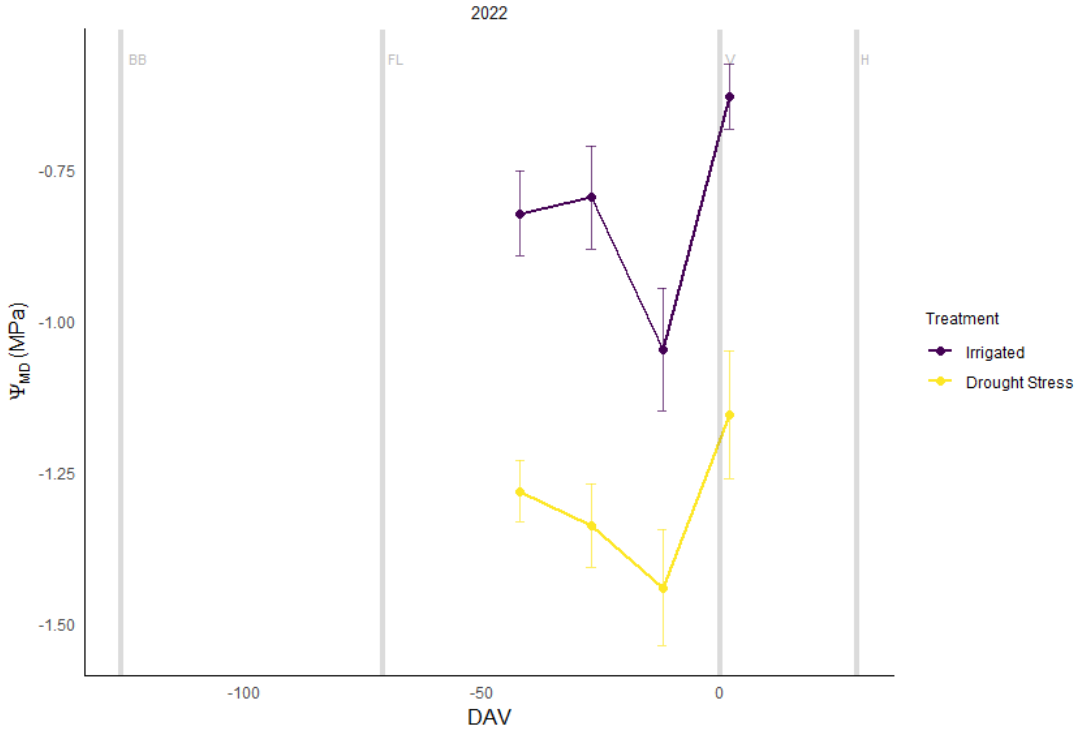


Figure S5. Midday water potential of Riesling grapevines under full irrigation and drought stress (no irrigation from flowering to veraison) in an irrigation trial in Prosser, (WA, USA), in 2022.

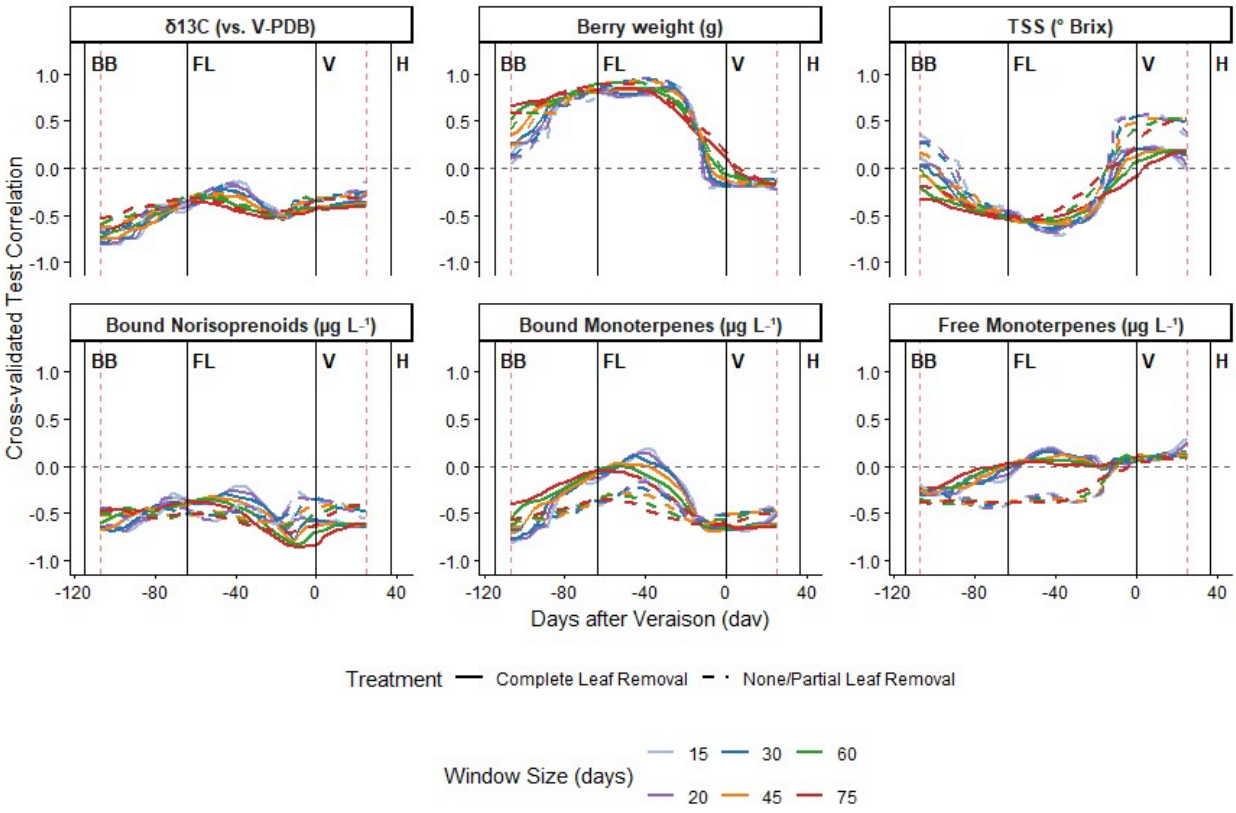


Figure S6. Correlation coefficients between simulated Ψ_{PD} of unirrigated vines of experiment 1a and 1b (years 2021-2024, total n = 18)) and target variables. Lines represent Pearson correlations of Ψ_{PD} moving averages and $\delta^{13}C$ (‰), total soluble solids (TSS, °Brix), berry weight (g), bound monoterpenes (µg L^{-1}), free monoterpenes (µg L^{-1}) and bound norisoprenoids (µg L^{-1}). Mean davs of main phenological stages (BB = budburst, FL = flowering, V = veraison, H = harvest) are depicted as solid vertical lines. Window size = duration in days over which the moving average was calculated.

Table S1. Irrigation water amounts applied in a Riesling vineyard located at Rüdesheimer Berg, Germany (Experiment 1a) during the 2022 growing season.

Date	Amount (mm)	Amount (L $plant^{-1}$)
10.05.2022	43.6	76.8
17.05.2022	29.1	51.2
02.06.2022	30.9	54.4
22.06.2022	18.2	32.0
26.07.2022	32.7	57.6
03.08.2022	9.1	16.0
Sum	163.6	288.0

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Table S2. Content (ng berry^{-1}) of aroma compounds in Riesling berries as affected by irrigation and partial *vs* full leaf removal. Data from an irrigation trial in the Rüdesheimer Berg, Germany, in the growing season 2022 (Experiment 1a). Data shown are means ± standard deviation (n = 3). Data were analysed with a linear mixed effects model with total soluble solids (TSS, °Brix), leaf removal intensity and wine $\delta^{13}C$ as fixed, and block as random factors, as well as leaf removal intensity × $\delta^{13}C$ interactions.

Defoliated	no	no	yes	yes	$\delta^{13}C$	LR	INT
Irrigated	no	yes	no	yes			
Juice Quality							
TSS (°Brix)	18.3 ± 0.72	17.37 ± 0.23	18.73 ± 0.75	18.07 ± 0.8	NA	NA	NA
Berry weight (g)	1.05 ± 0.14	1.61 ± 0.04	0.99 ± 0.12	1.52 ± 0.03	NA	NA	NA
δ13C (‰) vs. V-PDB	-20.25 ± 0.29	-22.43 ± 0.5	-20.26 ± 0.33	-22.57 ± 0.47	NA	NA	NA
Free Monoterpenes							
α-Terpineol	55.46 ± 10.2	40.4 ± 6.02	39.25 ± 16.33	55.62 ± 8.66	0.905	0.928	**0.025**
β-Myrcene	n.d.						
Citronellol	n.d.						
Geraniol	7.37 ± 1.45	8.53 ± 3.94	5.93 ± 1.21	7.2 ± 2.23	0.371	0.313	0.967
Hotrienol	42.97 ± 10.55	43.94 ± 13.34	41.86 ± 20.02	58.1 ± 15.26	0.143	0.249	0.186
Limonene							
Linalool oxide 1	2.46 ± 0.5	2.32 ± 0.69	2.36 ± 1.17	2.98 ± 0.89	0.554	0.497	0.358
Linalool	123.56 ± 22.7	95.1 ± 13.72	115.65 ± 58.73	127.41 ± 10.83	0.643	0.502	0.284
Nerol	2.61 ± 0.59	2.85 ± 0.3	2.16 ± 0.78	2.78 ± 0.27	0.193	0.403	0.546
Nerol oxide	n.d.						
Total	227.06 ± 44.4	184.61 ± 30.27	201.27 ± 95.56	246.9 ± 31.61	0.923	0.569	0.166
Free C_{13} Norisoprenoids							
β-Damascenone	0.97 ± 0.48	0.65 ± 0.17	0.88 ± 0.83	0.6 ± 0.25	0.192	0.765	0.919
Glycosylated Monoterpenes							
α-Terpineol	529.61 ± 97.52	532.61 ± 61.65	490.93 ± 5.79	696.05 ± 136.1	0.075	0.244	0.082
β-Myrcene	n.d.						
Hotrienol	94.79 ± 21.86	144.85 ± 22.71	85.18 ± 14.56	173.53 ± 37.62	**< 0.001**	0.344	0.085
Limonene	n.d.						
Linalool	41.1 ± 12.47	58.11 ± 10.83	35.89 ± 10.88	58.14 ± 13.48	**0.030**	0.720	0.718
Nerol oxide	79.64 ± 17.72	118.8 ± 21.68	81.04 ± 7.66	147.79 ± 25.49	**< 0.001**	0.080	0.105
Total	745.14 ± 134.25	854.37 ± 109.54	693.03 ± 23.6	1075.5 ± 169.32	**0.006**	0.208	0.063
Glycosylated C_{13} Norisoprenoids							
TDN	122.76 ± 39.93	158.99 ± 37.67	140.87 ± 30.82	223.19 ± 33.53	**0.028**	0.093	0.306
Vitispirane	155.28 ± 39.46	171.62 ± 36.2	175.06 ± 42.83	248.56 ± 42.8	0.103	0.084	0.267
β-Damascenone	11.82 ± 2.89	12.55 ± 2	8.93 ± 3.46	11.18 ± 1.73	0.360	0.207	0.632
Total	289.85 ± 81.59	343.16 ± 74.91	324.85 ± 76.56	482.92 ± 77.88	0.057	0.100	0.288

Table S3. Aroma compound concentration in wine from Riesling grapes harvested on 20 September 2022 from irrigated and unirrigated vines grown in Rüdesheim, Germany. Wine analysis was conducted on 23 January 2024. Data shown are means ± standard deviation (n = 3). Data were analysed with a linear mixed effects model with wine $\delta^{13}C$ as fixed, and block as random factors.

Irrigated	no			yes			$\delta^{13}C$	± %
Alc (%)	11.12	±	0.16	11.16	±	0.39	0.704	
δ13C (‰) vs. \	-23.51	±	0.03	-25.49	±	0.47	NA	
Free Monoterpenes [µg L^{-1}]								
α-Terpineol	100	±	17.29	53.43	±	8.2	**0.032**	87
β-Myrcene	7.27	±	1.7	4.73	±	0.58	0.055	54
Citronellol	2.07	±	0.32	1.8	±	0	0.241	15
Geraniol	n.d.							
Hotrienol	38.33	±	6.47	34.17	±	1.82	0.323	12
Limonene	5.13	±	0.15	4.57	±	0.35	**0.029**	12
Linalool oxide	25.1	±	4.01	19.2	±	0.53	0.106	31
Linalool oxide :	7.3	±	1.49	4.73	±	0.55	**0.041**	54
Linalool	21.4	±	5.67	15.33	±	1.7	0.168	40
Nerol	n.d.							
Nerol oxide	8.7	±	1.04	7.1	±	0.62	**0.048**	23
Total	208	±	34.42	140.3	±	12.73	**0.033**	48
Free C_{13} Norisoprenoids [µg L^{-1}]								
TDN	10	±	2.17	6.07	±	0.25	0.080	65
Vitispirane	25.8	±	1.85	15.23	±	1.76	**< 0.001**	69
β-Damascenor	1.27	±	0.47	1.13	±	0.15	0.490	12
Total	18.57	±	4.1	11.93	±	0.51	**0.034**	56
Glycosylated Monoterpenes [µg L^{-1}]								
α-Terpineol	28.8	±	4.95	23.07	±	1.88	0.125	25
β-Myrcene	n.d.							
Hotrienol	8.1	±	0.62	7.9	±	1.28	0.799	3
Limonene	6.27	±	0.06	5.8	±	0.1	**0.024**	8
Linalool	n.d.							
Nerol oxide	5.17	±	0.78	5	±	0.26	0.680	3
Total	48.33	±	6.25	41.77	±	3.36	**0.011**	16
Glycosylated C_{13} Norisoprenoids [µg L^{-1}]								
TDN	62.6	±	2.7	44.43	±	4.65	**0.006**	41
Vitispirane	58.73	±	5.25	44.3	±	2.62	**0.009**	33
β-Damascenor	n.d.							
Total	121.3	±	7.8	88.73	±	7.13	0.157	37

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Table S4. Vineyard block and leaf removal effects on aroma compound concentration in extracts from Riesling grapes sourced from three blocks of the experimental vineyard in Rüdesheim, Germany, with different water holding capacities (Experiment 1b). AWC is 75, 115, and 150 mm respectively for blocks 1 to 3. Data shown are weighted means ± standard deviation. Weights, but not sample sizes were equal for all years (total n2021,2023 = 12; total n2024 = 6). Data were analysed with a linear mixed effects model with leaf removal (LR) and extract $\delta^{13}C$ as fixed, and block and vintage as nested random factors. Results are shown as *p*-values of the fixed effects on the right hand side of the table, significant factors are marked in bold.

Leaf removal	no			yes			$\delta^{13}C$	LR	INT
Block	1	2	3	1	2	3			
Juice Quality									
TSS (°Brix)	18.45 ± 0.63	18.62 ± 0.18	18.83 ± 0.74	17.6 ± 0.71	18.82 ± 0.4	18.02 ± 0.62	0.701	0.054	0.252
Berry weight (g)	1.37 ± 0.13	1.57 ± 0.04	1.57 ± 0.04	1.27 ± 0.09	1.46 ± 0.05	1.49 ± 0.04	**<0.001**	**0.016**	0.555
δ13C (‰) vs. V-PDB	-22.35 ± 0.36	-25.15 ± 0.68	-24.52 ± 0.47	-22.55 ± 0.59	-24.97 ± 0.45	-24.87 ± 0.45	NA	NA	NA
Free Monoterpenes (µg L^{-1})									
α-Terpineol	27.73 ± 4.1	16.2 ± 2.19	21.87 ± 7.92	53.07 ± 8.38	35.62 ± 5.52	31.77 ± 4.37	**0.005**	**<0.001**	0.417
β-Myrcene	7.58 ± 0.11	5.12 ± 0.11	6.18 ± 2.23	11.77 ± 0.35	8.52 ± 1.74	6.73 ± 0.22	**<0.001**	**<0.001**	0.786
Citronellol	0.78 ± 0.11	0.83 ± 0.16	0.8 ± 0.1	0.78 ± 0.11	0.87 ± 0.1	0.78 ± 0.11	0.631	0.461	0.171
Geraniol	55.57 ± 17	37.87 ± 9.05	57.47 ± 19.83	102.02 ± 22.74	74.5 ± 8.77	73.62 ± 15.27	**0.007**	**<0.001**	0.510
Hotrienol	6.43 ± 1.25	4.68 ± 0.35	5.53 ± 1.73	9.12 ± 0.18	7.13 ± 1.3	6.52 ± 0.36	**0.003**	**<0.001**	0.759
Limonene	2.73 ± 0.57	1.93 ± 0.29	3.23 ± 0.71	4.43 ± 0.36	3.55 ± 0.7	3.42 ± 0.4	**0.023**	**<0.001**	0.941
Linalool oxide 1	0.58 ± 0.15	0.37 ± 0.2	0.47 ± 0.4	1.15 ± 0.3	0.9 ± 0.45	0.37 ± 0.16	0.163	**0.018**	0.320
Linalool	79.53 ± 5.39	46.13 ± 7.84	66.97 ± 31.03	143.15 ± 11.5	103.42 ± 27.33	83.18 ± 4.87	**0.002**	**<0.001**	0.631
Nerol	0.92 ± 0.25	0.93 ± 0	0.88 ± 0.15	1.6 ± 0.2	1.4 ± 0.6	1.13 ± 0	0.491	**0.004**	0.457
Nerol oxide	0.57 ± 0.16	0.45 ± 0.05	0.62 ± 0.11	0.95 ± 0.18	0.72 ± 0.05	0.73 ± 0.07	**0.002**	**<0.001**	0.534
Total	182.43 ± 27.57	114.52 ± 18.89	164.02 ± 63.07	328.03 ± 41.82	236.62 ± 44.82	208.25 ± 24.73	**<0.001**	**<0.001**	0.628
Free C_{13} Norisoprenoids (µg L^{-1})									
β-Damascenone	0.68 ± 0.36	0.5 ± 0.07	0.57 ± 0.14	0.87 ± 0.36	0.57 ± 0.07	0.72 ± 0.32	0.060	0.077	0.992
Glycosylated Monoterpenes (µg L^{-1})									
α-Terpineol	272.67 ± 10	169.58 ± 15.35	183.7 ± 63.54	371.33 ± 25.94	304.55 ± 52.19	228.22 ± 27.16	0.096	**<0.001**	0.992
β-Myrcene	4.57 ± 0.8	3.07 ± 0.4	3.03 ± 0.5	5.12 ± 0.35	4.47 ± 0.4	3.65 ± 1.15	0.095	**0.019**	0.078
Hotrienol	207.42 ± 50.63	142.7 ± 31.38	147.73 ± 28.4	213.82 ± 18.77	184.97 ± 22.27	149.72 ± 22.6	0.161	0.212	0.157
Limonene	11.48 ± 0.87	8.17 ± 1.3	8.6 ± 1.75	13.78 ± 0.3	11.97 ± 2.19	10.3 ± 1.98	**0.003**	**<0.001**	0.103
Linalool	17.08 ± 1.78	8.03 ± 2.47	7.52 ± 1.91	20.8 ± 3.29	13.65 ± 3.02	9.97 ± 2.56	0.681	**<0.001**	0.865
Nerol oxide	71.03 ± 21.35	57.95 ± 12.2	62.57 ± 15.25	81.67 ± 10	77.5 ± 4.08	68.77 ± 6.69	**0.043**	**0.033**	0.188
Total	584.25 ± 64.54	389.5 ± 42.41	413.15 ± 110.48	706.52 ± 30.86	597.1 ± 82.3	470.62 ± 54.56	0.074	**<0.001**	0.450
Glycosylated C_{13} Norisoprenoids (µg L^{-1})									
TDN	53.8 ± 2.57	47.12 ± 3.25	45.77 ± 13.45	75.78 ± 2.32	65.98 ± 3.03	61.3 ± 7.95	**0.021**	**<0.001**	0.595
Vitispirane	99.67 ± 10.88	81.43 ± 8.53	79.07 ± 20.69	135.27 ± 8.73	116.52 ± 9.61	104.75 ± 12.57	**0.049**	**<0.001**	0.914
β-Damascenone	14.13 ± 2.75	11.98 ± 0.74	9.5 ± 1.14	10.62 ± 1.31	9.15 ± 2.06	8.87 ± 0.47	0.090	**0.004**	0.263
Total	167.6 ± 16.04	140.53 ± 9.95	134.33 ± 32.67	221.67 ± 11.92	191.65 ± 11.97	174.92 ± 20.03	**0.010**	**<0.001**	0.693

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Table S5. Vineyard block and leaf removal effects on aroma compound content (ng berry^{-1}) in extracts from Riesling grapes sourced from three blocks with different water holding capacities (Experiment 1b) in the experimental vineyard in Rüdesheim, Germany (Years 2021, 2023, 2024). AWC is 75, 115, and 150 mm respectively for blocks 1 to 3. Data shown are weighted means ± standard deviation. Weights, but not sample sizes were equal for all years (total n2021,2023 = 12; total n2024 = 6). Data were analysed with a linear mixed effects model with leaf removal (LR) and extract $\delta^{13}C$ as fixed, and block and vintage as random factors. Results are shown as *p*-values of the individual factors on the right hand side of the table, significant factors are marked in bold.

Leaf removal	no			yes			$\delta^{13}C$	LR	INT
Block	1	2	3	1	2	3			
Juice Quality									
TSS (°Brix)	18.46 ± 0.62	18.63 ± 0.19	18.81 ± 0.74	17.61 ± 0.7	18.83 ± 0.41	18.01 ± 0.57	NA	NA	NA
Berry weight (g)	1.37 ± 0.13	1.57 ± 0.04	1.57 ± 0.04	1.27 ± 0.09	1.46 ± 0.05	1.49 ± 0.04	NA	NA	NA
δ13C (‰) vs. V-PDB	-22.74 ± 0.36	-24.95 ± 0.66	-24.52 ± 0.45	-22.11 ± 0.59	-25.15 ± 0.45	-24.86 ± 0.46	NA	NA	NA
Free Monoterpenes (ng berry-1)									
α-Terpineol	36.21 ± 6.81	23.86 ± 3	33.75 ± 12.32	67.71 ± 9.49	50.95 ± 9.37	46.84 ± 6.53	0.231	**< 0.001**	0.911
β-Myrcene	9.02 ± 1.36	7.15 ± 0.09	8.89 ± 2.73	14.17 ± 1.05	12.12 ± 1.98	9.9 ± 0.44	0.114	**0.002**	0.452
Citronellol	1.16 ± 0.13	1.42 ± 0.4	1.38 ± 0.15	1.05 ± 0.08	1.24 ± 0.21	1.15 ± 0.23	0.126	**0.033**	0.452
Geraniol	75.09 ± 20.52	61.64 ± 16.44	95.21 ± 33.06	131.51 ± 23.49	106.55 ± 12.47	113.42 ± 20.73	0.346	**< 0.001**	0.937
Hotrienol	6.95 ± 2.31	5.76 ± 0.3	7.17 ± 2.12	9.96 ± 0.73	9.18 ± 1.48	8.54 ± 0.86	0.970	**0.002**	0.455
Limonene	3.45 ± 1.18	3.01 ± 0.33	5.06 ± 1.16	5.55 ± 0.1	5.16 ± 0.82	5.31 ± 0.58	0.841	**0.007**	0.670
Linalool oxide 1	0.49 ± 0.33	0.39 ± 0.2	0.53 ± 0.48	1.12 ± 0.11	1.04 ± 0.54	0.52 ± 0.21	0.424	**0.009**	0.278
Linalool	100.54 ± 16.45	66.69 ± 13.97	104.09 ± 50.5	179.34 ± 7.22	145.53 ± 38.19	124.94 ± 6.59	0.147	**< 0.001**	0.940
Nerol	1.66 ± 0.65	1.87 ± 0.11	1.75 ± 0.2	2.45 ± 0.07	2.23 ± 1.13	1.87 ± 0.03	0.851	**0.042**	0.590
Nerol oxide	0.79 ± 0.16	0.73 ± 0.06	0.97 ± 0.17	1.22 ± 0.2	1 ± 0.11	1.11 ± 0.15	0.616	**0.001**	0.918
Total	235.36 ± 47.32	172.53 ± 32.86	258.81 ± 101.18	414.08 ± 40.73	335.01 ± 64.5	313.6 ± 34.06	0.177	**< 0.001**	0.981
Free C13 Norisoprenoids (ng berry-1)									
β-Damascenone	0.92 ± 0.54	0.85 ± 0.1	0.92 ± 0.21	1.1 ± 0.43	0.79 ± 0.09	1.07 ± 0.41	0.780	0.612	0.758
Glycosylated Monoterpenes (ng berry-1)									
α-Terpineol	370.57 ± 29.44	254.78 ± 19.14	290.12 ± 115.76	491.66 ± 10.31	457.28 ± 90.73	344.84 ± 25.02	0.385	**0.001**	0.605
β-Myrcene	5.25 ± 1.41	3.9 ± 0.39	3.99 ± 0.66	5.88 ± 0.12	6.25 ± 0.51	4.94 ± 1.02	0.906	**0.020**	0.065
Hotrienol	306.88 ± 102.24	238.92 ± 55.15	242.16 ± 50.05	291.94 ± 25.59	278.23 ± 46.14	233.32 ± 37.96	0.502	0.683	0.071
Limonene	13.63 ± 2.63	11.1 ± 1.44	12.16 ± 3.04	16.72 ± 0.94	16.8 ± 3.25	14.37 ± 1.63	0.900	**0.003**	0.177
Linalool	23.84 ± 2.34	12.39 ± 4.58	11.75 ± 3.32	27.4 ± 2.66	20.11 ± 4.65	14.7 ± 2.5	0.771	**0.005**	0.554
Nerol oxide	92.71 ± 33.22	89.2 ± 14.11	99.03 ± 28.24	104.8 ± 22	112.56 ± 9.53	104.91 ± 11.79	0.645	0.228	0.169
Total	812.88 ± 151.39	610.29 ± 69.99	659.22 ± 200.24	938.41 ± 48.86	891.23 ± 153.44	717.07 ± 69.6	0.467	**0.016**	0.203
Glycosylated C13 Norisoprenoids (ng berry-1)									
TDN	70.83 ± 5.36	69.98 ± 3.57	71.37 ± 25.84	97.93 ± 5.26	100.18 ± 6.01	92.16 ± 11.95	0.943	**0.001**	0.301
Vitispirane	133.73 ± 14.83	125.76 ± 14.55	126.33 ± 38.45	177.43 ± 9.21	174.49 ± 19.36	157.68 ± 15.9	0.946	**0.001**	0.457
β-Damascenone	19.42 ± 3.66	19.27 ± 0.84	14.9 ± 2.6	13.07 ± 1.09	13.12 ± 2.33	12.88 ± 0.57	0.799	**0.001**	0.406
Total	223.98 ± 22.77	215.01 ± 16.05	212.6 ± 61.44	288.42 ± 14.61	287.78 ± 25.81	262.71 ± 26.91	0.967	**0.001**	0.321

SUPPLEMENTARY DATA
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Table S6. Content (ng berry^{-1}) of aroma compounds Riesling of berries sampled in Prosser, WA, on 08 October 2022, as affected by irrigation and early (ELR) or late (LLR) partial leaf removal (Experiment 2). Data shown are means ± standard deviation (n = 5). Data were analysed with a linear mixed effects model with total soluble solids (TSS, °Brix), leaf removal intensity and $\delta^{13}C$ as fixed, and row as random factors, as well as leaf removal intensity × $\delta^{13}C$ interactions.

Irrigation	RDI			Full			$\delta^{13}C$	LR	INT
Treatment	Control	ELR	LLR	Control	ELR	LLR			
Juice Quality									
TSS (°Brix)	20.1 ± 0.37	20.82 ± 1.08	20.22 ± 1.07	19.18 ± 0.93	19.72 ± 0.37	19.58 ± 0.41	NA		
Berry weight (g)									
δ13C (‰) vs. V-PDI	-25.38 ± 0.27	-25.79 ± 0.42	-25.33 ± 0.28	-27.41 ± 0.18	-27.4 ± 0.28	-27.47 ± 0.08			
Free Monoterpenes (ng berry $^{-1}$)									
α-Terpineol	14.96 ± 4.76	17.31 ± 3.27	18.79 ± 2.9	9.72 ± 1.55	11.7 ± 3.27	14.74 ± 2.83	**0.006**	**0.012**	0.765
β-Myrcene	1.39 ± 0.28	1.55 ± 0.35	1.64 ± 0.48	2.4 ± 0.48	2 ± 0.66	2.36 ± 0.69	0.572	0.544	0.47
Citronellol	1 ± 0.19	1.12 ± 0.25	1.11 ± 0.12	2.9 ± 0.36	2.88 ± 0.31	3.11 ± 0.68	**0.026**	0.405	0.927
Geraniol	8.84 ± 4.54	10.28 ± 4.24	11.52 ± 2.12	24.23 ± 5.94	21.25 ± 3.57	26.74 ± 9.42	**< 0.001**	0.172	0.969
Hotrienol	49.58 ± 13.86	53.71 ± 8.35	54.54 ± 7.67	42.28 ± 11.88	52.18 ± 17.11	51.32 ± 13.89	0.644	0.397	0.686
Limonene	0.96 ± 0.17	1.06 ± 0.31	1.08 ± 0.14	0.92 ± 0.21	0.92 ± 0.3	1.16 ± 0.28	**0.658**	0.246	0.436
Linalool oxide 1	3.17 ± 1.04	3.42 ± 0.54	3.45 ± 0.66	3.45 ± 0.85	3.83 ± 0.63	4.4 ± 0.62	0.058	0.18	0.53
Linalool	28.03 ± 11.14	32.92 ± 8.76	36.67 ± 8.92	12.63 ± 5.88	19.29 ± 9.12	29.74 ± 9.59	**0.011**	**0.011**	0.437
Nerol	1.78 ± 0.71	1.94 ± 0.39	2.09 ± 0.27	3.11 ± 0.56	3.13 ± 0.36	3.58 ± 1.03	**< 0.001**	0.225	0.88
Nerol oxide	0.58 ± 0.12	0.66 ± 0.06	0.66 ± 0.05	0.62 ± 0.12	0.57 ± 0.03	0.66 ± 0.16	0.668	0.387	0.527
Total	110.3 ± 34.49	123.97 ± 17.71	131.56 ± 19.28	102.25 ± 20.75	117.75 ± 16.93	137.81 ± 27.5	0.934	**0.044**	0.74
Free C_{13} Norisoprenoids (ng berry $^{-1}$)									
β-Damascenone	0.75 ± 0.12	0.87 ± 0.23	0.86 ± 0.24	0.58 ± 0.13	0.53 ± 0.21	0.56 ± 0.3	0.149	0.833	0.794
Glycosylated Monoterpenes (ng berry $^{-1}$)									
α-Terpineol	113.67 ± 30.16	131.57 ± 10.87	146.08 ± 34.45	103.13 ± 15.3	138.15 ± 32.11	167.73 ± 68.43	0.758	**0.023**	0.627
β-Myrcene	2.39 ± 0.46	2.55 ± 0.16	2.94 ± 0.39	2.5 ± 0.24	2.72 ± 0.61	3.93 ± 1.06	0.152	**0.001**	0.179
Hotrienol	86.86 ± 23.77	105.14 ± 8.87	122.18 ± 35.92	133.92 ± 21.8	142.81 ± 38.53	171.15 ± 47.12	**0.001**	**0.049**	0.994
Limonene	3.94 ± 0.61	4.05 ± 0.23	4.62 ± 0.73	4.6 ± 0.52	5.05 ± 0.55	6.16 ± 1.68	**0.023**	**0.016**	0.478
Linalool	5.47 ± 1.71	6.9 ± 0.87	7.93 ± 2.35	3.49 ± 1.01	4.66 ± 2.37	7.27 ± 3.46	0.075	**0.012**	0.463
Nerol oxide	39.66 ± 7.38	42.86 ± 3.98	48.93 ± 12.05	67.86 ± 9.95	73.16 ± 12.24	95.08 ± 17.14	**< 0.001**	**0.002**	0.267
Total	252 ± 62.01	293.07 ± 17.66	332.68 ± 82.79	315.5 ± 44.96	366.55 ± 68.72	451.32 ± 136.19	**0.013**	**0.016**	0.739
Glycosylated C_{13} Norisoprenoids (ng berry $^{-1}$)									
TDN	30.76 ± 5.29	31.81 ± 3.23	37.07 ± 5.26	18.37 ± 4.69	19.85 ± 15.33	29.59 ± 6.55	**0.003**	**0.05**	0.42
Vitispirane	52.24 ± 12.15	62.89 ± 8.06	65.15 ± 23.91	40.04 ± 10.19	42.18 ± 31.17	61.07 ± 17.24	0.208	0.131	0.375
β-Damascenone	4.89 ± 0.88	4.7 ± 0.76	6.8 ± 2.22	11.35 ± 3.2	8.66 ± 2.73	11.61 ± 2.03	0.682	**0.019**	0.387
Total	87.89 ± 16.42	99.39 ± 11.78	109.02 ± 29.71	69.76 ± 16.36	70.7 ± 48.64	102.26 ± 22.73	0.173	0.079	0.409

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Table S7. Concentration of aroma compounds in Riesling berry extracts as affected by irrigation and partial *vs* full leaf removal. Data from an irrigation trial in the Rüdesheimer Berg, Germany, in the growing season 2022 (Experiment 1a). Data shown are means ± standard deviation (total n = 123). Data were analysed with a linear mixed effects model leaf removal intensity and irrigation as fixed, and block as random factors, as well as leaf removal intensity × $\delta^{13}C$ interactions.

Leaf removal	partial	partial	full	full	IRR	LR	INT
Irrigated	no	yes	no	yes			
Juice Quality							
TSS (°Brix()	18.3 ± 0.72	17.37 ± 0.23	18.73 ± 0.75	18.07 ± 0.8	0.137	0.457	0.741
Berry weight (g)	1.05 ± 0.14	1.61 ± 0.04	0.99 ± 0.12	1.52 ± 0.03	**0.000**	0.453	0.741
δ13C (‰) vs. V-PDB	-20.25 ± 0.29	-22.43 ± 0.5	-20.26 ± 0.33	-22.57 ± 0.47	NA	NA	NA
Free Monoterpenes [µg L^{-1}]							
α-Terpineol	52.57 ± 5.02	25 ± 3.24	38.63 ± 11.32	36.77 ± 6.55	**0.002**	**0.032**	**0.011**
β-Myrcene	n.d	n.d	n.d	n.d			
Citronellol	n.d	n.d	n.d	n.d			
Geraniol	7.2 ± 2.43	5.27 ± 2.37	5.93 ± 0.49	4.73 ± 1.4	0.136	0.302	0.661
Hotrienol	40.43 ± 5.12	27.2 ± 7.96	40.97 ± 16.07	38.4 ± 10.55	0.058	0.928	0.231
Limonene	n.d	n.d	n.d	n.d			
Linalool oxide 1	2.33 ± 0.31	1.43 ± 0.4	2.3 ± 0.92	1.97 ± 0.59	0.077	0.940	0.380
Linalool	116.97 ± 9.33	58.83 ± 7.21	112.83 ± 44.36	84.13 ± 8.99	**0.018**	0.826	0.291
Nerol	2.47 ± 0.31	1.77 ± 0.15	2.13 ± 0.51	1.83 ± 0.21	**0.028**	0.219	0.289
Nerol oxide	n.d	n.d	n.d	n.d			
Total	214.77 ± 19.32	114.23 ± 16.63	196.87 ± 71.11	163.1 ± 24.2	**0.013**	0.535	0.153
Free C_{13} Norisoprenoids [µg L^{-1}]							
β-Damascenone	0.9 ± 0.35	0.4 ± 0.1	0.83 ± 0.71	0.4 ± 0.17	0.093	0.799	0.857
Glycosylated Monoterpenes [µg L^{-1}]							
α-Terpineol	509.13 ± 110.81	330 ± 35.4	499.43 ± 64.43	458.57 ± 85.93	**0.007**	0.836	0.072
β-Myrcene	n.d	n.d	n.d	n.d			
Hotrienol	90.87 ± 21.63	89.63 ± 12.53	87.7 ± 24.19	114.1 ± 22.71	0.873	0.683	**0.038**
Limonene	n.d	n.d	n.d	n.d			
Linalool	38.43 ± 7.02	36.07 ± 6.96	36.43 ± 11.97	38.3 ± 8.54	0.755	0.791	0.693
Nerol oxide	76.5 ± 18.52	73.5 ± 12.22	82.83 ± 15.97	97.23 ± 14.91	0.575	0.257	0.051
Total	714.93 ± 144.73	529.2 ± 62.01	706.4 ± 107.93	708.2 ± 101.9	**0.011**	0.873	**0.041**
Glycosylated C_{13} Norisoprenoids [µg L^{-1}]							
TDN	115.2 ± 29.27	98.27 ± 21.61	140.93 ± 15.28	146.93 ± 19.71	0.383	0.203	0.403
Vitispirane	146.67 ± 27.66	106.07 ± 20.29	175.17 ± 26.42	163.6 ± 25.65	0.096	0.215	0.356
β-Damascenone	11.1 ± 1.39	7.77 ± 1.1	8.8 ± 2.33	7.37 ± 1.07	**0.040**	0.121	0.332
Total	272.97 ± 57.39	212.1 ± 42.38	324.9 ± 43.03	317.9 ± 46.3	0.169	0.230	0.365