

Table S1. Weather conditions during vintages 2016 and 2017 (obtained from the website of the Australian Government Bureau of Meteorology using the Ararat Prison Observation Station data).

	December	January	February	March	April
Vintage 2016					
Mean maximum temperature (°C)	30.0	28.6	27.4	25.8	21.9
Mean minimum temperature (°C)	11.1	13.0	12.3	12.2	9.4
Mean rainfall (mm)	30.0	50.6	32.0	33.4	14.8
Solar radiation (MJ m ⁻²)	27.3	24.1	23.0	16.7	12.8
Vintage 2017					
Mean maximum temperature (°C)	26.3	29.0	27.2	27.7	20.7
Mean minimum temperature (°C)	10.5	12.4	10.8	12.0	8.4
Mean rainfall (mm)	50.0	33.0	18.6	24.0	70.0
Solar radiation (MJ m ⁻²)	23.6	24.4	21.5	17.3	10.9

Table S2. Free terpene concentrations in Shiraz grape at harvest under different UV attenuation treatments in vintage 2016.

Peak No.	Compound	LRI		Concentration of free terpenes in the grapes									P(film)	P(stag e)
		NIS	LRI	Control	TW PC	TW PETG	TV PC	TV PETG	TI PC	TI PETG	TH PC	TH PETG		
Monoterpenes (µg/g)														
1	Cymene (m- and p-)	1026	1023	0.40 ± 0.06a	0.19 ± 0.11b	0.50 ± 0.09a	0.32 ± 0.11	0.63 ± 0.20	0.15 ± 0.03	0.22 ± 0.04	0.47 ± 0.21	0.75 ± 0.12	0.000	0.000
2	γ-Terpinene	1062	1056	0.18 ± 0.06b	0.14 ± 0.16b	0.52 ± 0.07a	0.25 ± 0.10	0.40 ± 0.11	0.15 ± 0.08	0.22 ± 0.07	0.36 ± 0.21	0.74 ± 0.19	0.001	0.000
3	Linalool	1098	1098	1.75 ± 0.29b	0.86 ± 0.26c	2.53 ± 0.45a	1.66 ± 0.37	2.03 ± 0.23	0.95 ± 0.13	1.38 ± 0.22	1.89 ± 0.60	1.60 ± 0.26	0.175	0.000
4	Citronellal	1150	1132	3.78 ± 2.40	1.65 ± 1.34	3.41 ± 2.75	3.20 ± 1.52	3.38 ± 2.46	2.07 ± 1.37	2.69 ± 1.63	3.61 ± 2.30	2.67 ± 1.88	0.946	0.527
5	Menthol (+isomenthol)	1174	1179	1.19 ± 0.69	0.45 ± 0.40	1.14 ± 0.86	0.98 ± 0.40	0.93 ± 0.67	0.58 ± 0.41	0.77 ± 0.54	0.96 ± 0.70	0.74 ± 0.51	0.883	0.532
6	α-Terpineol	1189	1197	0.99 ± 0.23ab	0.38 ± 0.30b	1.62 ± 0.54a	1.00 ± 0.40	1.24 ± 0.61	0.58 ± 0.32	0.73 ± 0.35	0.80 ± 0.13	1.15 ± 0.74	0.188	0.128
7	Geraniol	1255	1255	6.89 ± 0.39	5.46 ± 1.14	5.46 ± 0.97	5.86 ± 1.25	4.40 ± 0.43	5.56 ± 0.87	5.94 ± 1.98	4.23 ± 1.85	2.97 ± 0.52	0.114	0.003
8	Geranylacetone	1452	1441	16.34 ± 5.73	9.15 ± 3.82	16.14 ± 2.04	9.26 ± 1.10	13.95 ± 0.70	6.27 ± 1.03	6.84 ± 1.75	9.07 ± 3.33	9.35 ± 2.27	0.019	0.000
	Total			31.33 ± 8.37	18.29 ± 6.61	30.93 ± 7.54	22.53 ± 1.56	24.17 ± 4.61	16.28 ± 2.43	18.66 ± 5.51	21.24 ± 7.89	19.96 ± 5.34		
Norisoprenoids (µg/kg)														
9	Theaspirane (isomer 1)	1298	1292	0.05 ± 0.00b	0.06 ± 0.00b	0.11 ± 0.01a	0.06 ± 0.03	0.08 ± 0.02	0.05 ± 0.01	0.05 ± 0.01	0.06 ± 0.02	0.07 ± 0.02	0.206	0.038
10	Theaspirane (isomer 2)	1298	1308	0.04 ± 0.01b	0.03 ± 0.01b	0.07 ± 0.01a	0.05 ± 0.01	0.06 ± 0.01	0.03 ± 0.00	0.03 ± 0.00	0.04 ± 0.01	0.06 ± 0.01	0.005	0.001
11	(E)-β-Damascenone	1385	1373	1.90 ± 0.48b	0.65 ± 0.03c	4.92 ± 0.48a	1.64 ± 0.26	3.89 ± 0.45	1.11 ± 0.33	2.40 ± 0.27	3.29 ± 0.93	3.96 ± 0.16	0.000	0.000

12	β -Ionone	1470	1465	0.04 \pm 0.00b	0.08 \pm 0.02a	0.03 \pm 0.01b	0.08 \pm 0.04	0.03 \pm 0.01	0.03 \pm 0.01	0.02 \pm 0.01	0.06 \pm 0.02	0.06 \pm 0.03	0.040	0.011
Total				2.03 \pm 0.49	0.69 \pm 0.30	5.13 \pm 0.49	1.83 \pm 0.29	4.07 \pm 0.47	1.22 \pm 0.35	2.50 \pm 0.27	3.44 \pm 0.96	4.15 \pm 0.17		
Sesquiterpenes ($\mu\text{g}/\text{kg}$)														
13	α -Ylangene	1372	1347	0.06 \pm 0.03	0.03 \pm 0.01	0.06 \pm 0.01	0.05 \pm 0.02	0.07 \pm 0.02	0.03 \pm 0.02	0.04 \pm 0.01	0.09 \pm 0.09	0.05 \pm 0.03	0.798	0.294
14	β -Bourbonene	1384	1364	0.07 \pm 0.01b	0.03 \pm 0.01c	0.11 \pm 0.01a	0.05 \pm 0.01	0.09 \pm 0.01	0.04 \pm 0.00	0.06 \pm 0.01	0.07 \pm 0.02	0.09 \pm 0.02	0.000	0.000
16	α -Humulene	1452	1439	0.04 \pm 0.01ab	0.02 \pm 0.01b	0.04 \pm 0.01a	0.03 \pm 0.00	0.04 \pm 0.01	0.02 \pm 0.00	0.02 \pm 0.01	0.02 \pm 0.01	0.02 \pm 0.00	0.654	0.000
17	α -Muurolene	1499	1501	0.04 \pm 0.01c	2.15 \pm 0.16b	3.29 \pm 0.22a	1.67 \pm 0.45	3.40 \pm 0.47	0.02 \pm 0.01	0.03 \pm 0.01	2.29 \pm 0.77	3.57 \pm 0.25	0.000	0.000
18	γ -Cadinene	1501	1501	3.89 \pm 0.60a	2.86 \pm 0.24b	4.41 \pm 0.41a	2.17 \pm 0.62	4.57 \pm 0.63	2.53 \pm 0.59	2.92 \pm 0.22	2.99 \pm 1.02	4.73 \pm 0.34	0.000	0.003
20	Calamenene (cis+trans)	1521	1513	0.03 \pm 0.00b	0.02 \pm 0.01b	0.05 \pm 0.00a	0.03 \pm 0.01	0.04 \pm 0.01	0.02 \pm 0.00	0.03 \pm 0.00	0.04 \pm 0.01	0.06 \pm 0.01	0.000	0.000
22	α -Calacorene	1523	1533	0.18 \pm 0.01a	0.11 \pm 0.02b	0.20 \pm 0.03a	0.09 \pm 0.03	0.19 \pm 0.04	0.10 \pm 0.01	0.13 \pm 0.02	0.15 \pm 0.02	0.28 \pm 0.05	0.000	0.000
24	1-epi-Cubenol	1625	1619	0.03 \pm 0.01	0.02 \pm 0.00	0.03 \pm 0.01	0.02 \pm 0.00	0.03 \pm 0.00	0.02 \pm 0.00	0.02 \pm 0.00	0.02 \pm 0.01	0.03 \pm 0.00	0.000	0.000
25	γ -Eudesmol	1628	1619	0.04 \pm 0.02	0.03 \pm 0.01	0.05 \pm 0.01	0.03 \pm 0.01	0.05 \pm 0.00	0.02 \pm 0.01	0.02 \pm 0.01	0.01 \pm 0.00	0.02 \pm 0.01	0.000	0.000
27	Cadalene	1672	1660	0.05 \pm 0.00b	0.03 \pm 0.00c	0.06 \pm 0.00a	0.03 \pm 0.01	0.06 \pm 0.02	0.03 \pm 0.00	0.04 \pm 0.01	0.06 \pm 0.01	0.09 \pm 0.02	0.000	0.000
Total				4.46 \pm 0.62	4.31 \pm 2.21	8.13 \pm 1.12	4.18 \pm 1.08	8.52 \pm 1.16	2.83 \pm 0.58	2.73 \pm 1.32	5.75 \pm 1.83	8.95 \pm 0.56		
Total	free terpene compound ($\mu\text{g}/\text{g}$)			31.34 \pm 8.37	18.29 \pm 6.61	30.94 \pm 7.54	22.53 \pm 1.56	24.18 \pm 4.61	16.28 \pm 2.43	18.66 \pm 5.51	21.24 \pm 7.89	19.98 \pm 5.34		

Linalool, α -terpineol, geraniol and geranylacetone were quantified using pure standard compounds. Cymene (m- and p-) and γ -terpinene were semi-quantified using a linalool standard. Citronellal and menthol(+isomenthol) were semi-quantified using an α -terpineol standard. All sesquiterpenoids and free norisoprenoids were semi-quantified with the internal standard β -cedrene and expressed as equivalent concentrations of the internal standard. *All monoterpenes were expressed at the $\mu\text{g}/\text{g}$ grape sample. *All sesquiterpenes and norisoprenoids were expressed at the $\mu\text{g}/\text{kg}$ grape sample. *Total free terpene compounds were expressed at the $\mu\text{g}/\text{g}$ grape sample. *ND: not detected. *Different letters in the column represent significantly different means \pm SD ($p < 0.05$). *P(film): UV attenuation effects by different films; P(stage): phenological stage effect, achieved by two-way ANOVA at $p < 0.05$.

Table S3. Free terpene concentrations in Shiraz grape at harvest under different UV attenuation treatments in vintage 2017.

Peak No.	Compound	LRI NIST	LRI	concentration of free terpenes in the grapes									P(fil m)	P(stag e)
				Control	TW PC	TW PETG	TV PC	TV PETG	TI PC	TI PETG	TH PC	TH PETG		
Monoterpenes (µg/g)														
1	Cymene (m- and p-)	1026	1025	0.09 ± 0.02	0.20 ± 0.18	0.19 ± 0.04	0.14 ± 0.08	0.19 ± 0.07	0.23 ± 0.06	0.12 ± 0.04	0.15 ± 0.04	0.08 ± 0.05	0.049	0.096
2	γ-Terpinene	1062	1057	0.10 ± 0.02	0.11 ± 0.06	0.16 ± 0.05	0.32 ± 0.13	0.23 ± 0.05	0.29 ± 0.13	0.12 ± 0.03	0.02 ± 0.01	0.06 ± 0.02	0.021	0.000
3	Linalool	1098	1099	0.75 ± 0.05	0.81 ± 0.26	1.04 ± 0.12	0.96 ± 0.36	1.03 ± 0.14	1.18 ± 0.30	0.39 ± 0.06	1.02 ± 0.06	0.68 ± 0.08	0.000	0.090
4	Citronellal	1150	1133	0.27 ± 0.20	0.41 ± 0.21	1.67 ± 2.03	0.20 ± 0.17	1.69 ± 1.70	1.66 ± 1.76	0.29 ± 0.22	0.3 ± 0.23	0.24 ± 0.25	0.958	0.256
5	Menthol (± isomenthol)	1174	1180	0.50 ± 0.31	0.91 ± 0.93	0.98 ± 1.08	0.28 ± 0.27	1.04 ± 1.10	1.15 ± 1.24	0.40 ± 0.36	0.29 ± 0.29	0.20 ± 0.22	0.926	0.267
6	α-Terpineol	1189	1198	0.68 ± 0.29	0.87 ± 0.51	0.60 ± 0.36	0.64 ± 0.40	0.67 ± 0.42	0.67 ± 0.38	0.74 ± 0.49	0.87 ± 0.60	0.62 ± 0.44	0.766	0.908
7	Geraniol	1255	1256	2.05 ± 0.17	2.34 ± 0.27	2.16 ± 0.30	2.36 ± 0.23	2.03 ± 0.36	2.17 ± 0.15	1.77 ± 0.08	3.31 ± 0.70	2.93 ± 0.64	0.028	0.000
8	Geranylacetone	1452	1441	7.87 ± 0.88	8.18 ± 3.44	4.40 ± 2.85	7.42 ± 3.54	6.26 ± 4.78	8.83 ± 3.51	8.02 ± 1.26	5.79 ± 3.32	7.44 ± 1.37	0.928	0.406
	Total			12.12 ± 3.79	13.74 ± 5.03	11.01 ± 6.44	12.17 ± 4.20	13.13 ± 8.22	16.18 ± 6.58	11.85 ± 2.34	11.55 ± 4.23	12.24 ± 2.71		
Norisoprenoids (µg/kg)														
9	Theaspirane (isomer 1)	1298	1293	0.06 ± 0.01a	0.05 ± 0.00b	0.04 ± 0.01ab	0.05 ± 0.01	0.05 ± 0.00	0.06 ± 0.02	0.05 ± 0.01	0.06 ± 0.00	0.07 ± 0.01	0.780	0.015
10	Theaspirane (isomer 2)	1298	1309	0.04 ± 0.01a	0.04 ± 0.00ab	0.03 ± 0.01b	0.04 ± 0.01	0.04 ± 0.01	0.04 ± 0.01	0.04 ± 0.00	0.04 ± 0.00	0.04 ± 0.01	0.367	0.056
11	(E)-β-Damascenone	1385	1373	1.13 ± 0.13	1.08 ± 0.06	1.09 ± 0.13	1.11 ± 0.14	1.39 ± 0.35	1.15 ± 0.31	0.97 ± 0.18	1.85 ± 0.31	0.89 ± 0.10	0.004	0.226
12	β-Ionone	1470	1466	0.03 ± 0.02	0.05 ± 0.02	0.07 ± 0.04	0.06 ± 0.04	0.04 ± 0.00	0.09 ± 0.04	0.05 ± 0.01	0.04 ± 0.01	0.06 ± 0.02	0.120	0.073
	Total			1.27 ± 0.12	0.99 ± 0.47	1.24 ± 0.16	1.27 ± 0.16	1.51 ± 0.35	1.34 ± 0.34	1.11 ± 0.18	2.00 ± 0.31	0.88 ± 0.42		

Sesquiterpenes ($\mu\text{g}/\text{kg}$)														
13	α -Ylangene	1372	1348	0.01 \pm 0.00	ND	ND	0.01 \pm 0.01	0.02 \pm 0.00	0.02 \pm 0.01	ND	0.03 \pm 0.02	0.01 \pm 0.00	0.013	0.067
14	β -Bourbonene	1384	1365	0.03 \pm 0.00	0.03 \pm 0.00	0.03 \pm 0.00	0.03 \pm 0.01	0.03 \pm 0.00	0.03 \pm 0.01	0.03 \pm 0.01	0.04 \pm 0.01	0.03 \pm 0.00	0.222	0.204
15	cis-muurola-4(15),5-diene	1462	1461	0.05 \pm 0.03	0.08 \pm 0.04	0.10 \pm 0.09	0.07 \pm 0.06	0.09 \pm 0.04	0.17 \pm 0.14	0.06 \pm 0.03	0.05 \pm 0.02	0.04 \pm 0.02	0.249	0.073
16	α -Humulene	1452	1440	0.02 \pm 0.01	0.02 \pm 0.00	0.02 \pm 0.00	0.02 \pm 0.00	0.02 \pm 0.01	0.02 \pm 0.00	0.02 \pm 0.00	0.02 \pm 0.01	0.02 \pm 0.01	0.570	0.775
17	α -Muurolene	1499	1491	0.03 \pm 0.01	0.03 \pm 0.01	0.04 \pm 0.01	0.03 \pm 0.00	0.04 \pm 0.01	0.03 \pm 0.00	0.03 \pm 0.00	0.05 \pm 0.01	0.03 \pm 0.01	0.527	0.029
18	γ -Cadinene	1501	1500	3.01 \pm 0.83a	2.21 \pm 1.78ab	0.30 \pm 0.03b	1.37 \pm 1.46	0.30 \pm 0.03	0.29 \pm 0.04	3.22 \pm 0.53	3.25 \pm 0.81	3.28 \pm 0.68	0.246	0.000
19	δ -Cadinene	1510	1511	ND	0.10 \pm 0.05	0.05 \pm 0.03	0.05 \pm 0.03	0.08 \pm 0.03	0.06 \pm 0.03	ND	ND	ND	0.339	0.000
20	Calamenene (cis+trans)	1521	1513	0.04 \pm 0.01	0.06 \pm 0.04	0.06 \pm 0.01	0.06 \pm 0.02	0.08 \pm 0.01	0.07 \pm 0.02	0.05 \pm 0	0.05 \pm 0.01	0.03 \pm 0.01	0.169	0.003
21	Zonarene	1528	1514	ND	0.02 \pm 0.01	0.01 \pm 0.01	0.01 \pm 0.01	0.02 \pm 0.00	0.06 \pm 0.03	ND	ND	ND	0.049	0.018
22	α -Calacorene	1523	1533	0.13 \pm 0.01	0.11 \pm 0.00	0.13 \pm 0.04	0.13 \pm 0.04	0.17 \pm 0.05	0.15 \pm 0.08	0.12 \pm 0.01	0.21 \pm 0.02	0.10 \pm 0.02	0.062	0.503
23	ω -Cadinene	1526	1525	ND	0.04 \pm 0.02	0.03 \pm 0.01	0.03 \pm 0.01	0.04 \pm 0.01	0.04 \pm 0.02	ND	ND	ND	0.075	0.000
24	1-epi-Cubenol	1625	1618	0.02 \pm 0.00b	0.03 \pm 0.01ab	0.04 \pm 0.02a	0.03 \pm 0.02	0.05 \pm 0.02	0.04 \pm 0.03	0.02 \pm 0.00	0.02 \pm 0.00	0.02 \pm 0.00	0.762	0.037
25	γ -Eudesmol	1628	1622	0.01 \pm 0.00	0.02 \pm 0.00	0.02 \pm 0.02	0.01 \pm 0.00	0.03 \pm 0.02	0.03 \pm 0.03	0.01 \pm 0.00	0.01 \pm 0.00	0.01 \pm 0.00	0.577	0.003
26	Cubenol	1643	1632	ND	0.04 \pm 0.02	0.03 \pm 0.02	0.03 \pm 0.02	0.04 \pm 0.01	0.04 \pm 0.02	0.02 \pm 0.00	0.02 \pm 0.00	0.02 \pm 0.00	0.863	0.280
27	Cadalene	1672	1660	0.05 \pm 0.00	0.04 \pm 0.00	0.04 \pm 0.00	0.04 \pm 0.01	0.06 \pm 0.01	0.04 \pm 0.02	0.04 \pm 0.01	0.07 \pm 0.01	0.04 \pm 0.00	0.044	0.019
Total				3.39 \pm 0.84	2.73 \pm 1.68	0.89 \pm 0.22	1.91 \pm 1.39	1.06 \pm 0.19	1.06 \pm 0.43	2.97 \pm 1.50	3.82 \pm 0.86	3.63 \pm 0.68		
Total	free terpene compounds ($\mu\text{g}/\text{g}$)			12.13 \pm 3.79	13.75 \pm 5.03	11.01 \pm 6.44	12.18 \pm 4.20	13.14 \pm 8.22	16.19 \pm 6.58	11.85 \pm 2.34	11.55 \pm 4.23	12.25 \pm 2.71		

Linalool, α -terpineol, geraniol and geranylacetone were quantified using pure standard compounds. Cymene (m- and p-) and γ -terpinene were semi-quantified using a linalool standard. Citronellal and menthol(+isomenthol) were semi-quantified using an α -terpineol standard. All sesquiterpenoids and free norisoprenoids were semi-quantified with the internal standard β -cedrene and expressed as equivalent concentrations of the internal standard. *All monoterpenes were expressed at the $\mu\text{g}/\text{g}$ grape

sample. *All sesquiterpenes and norisoprenoids were expressed at the $\mu\text{g}/\text{kg}$ grape sample. *Total free terpene compounds were expressed at the $\mu\text{g}/\text{g}$ grape sample. *ND: not detected. *Different letters in the column represent significantly different means \pm SD ($p < 0.05$). *P(film): UV attenuation effects by different films; P(stage): phenological stage effect, achieved by two-way ANOVA at $p < 0.05$.