Supplementary Table S1. Basic wine parameters in the initial wine and in the wine samples after 6, 12 and 24 months of storage

Parameter[1]	Units	Analysis after bottling	Analysis after storage time[2,3,4]					
			6 months		12 months		24 months	
			Cool	Warm	Cool	Warm	Cool	Warm
Density	20/20	0.9956 ± 0.0002	0.9957 ± $3*10^{-16}$		0.9955 ± 0.0004		0.9956 ±0.0003	
Alcohol	g/L	98.4 ± 1.1	97.9 ± 0.9		98.7 ± 1.0		97.8 ± 0.9	
Glycerol	g/L	5.6 ± 0.1	5.6 ± 0.1		5.7 ± 0.1		5.6 ± 0.1	
Extract	g/L	28.7 ± 0.1	27.8 ± 0.1	29.3 ± 0.2	28.3 ± 0.2	30.1 ± 0.3	29.5 ± 0.3	31.2 ± 0.4
Sugar-free Extract	g/L	21.6 ± 0.2	20.7 ± 0.2	22.3 ± 0.2	21.1 ± 0.2	22.9 ± 0.2	22.3 ± 0.3	24.1 ± 0.4
Fermentable Sugars	g/L	7.1 ± 0.1	7.1 ± 0.1		7.2 ± 0.1		7.1 ± 0.1	
Glucose	g/L	3.3 ± 0.1	3.2 ± 0.1		3.4 ± 0.1		3.5 ± 0.1	
Fructose	g/L	3.8 ± 0.1	3.8 ± 0.1		3.8 ± 0.1		3.7 ± 0.1	
pH		3.5 ± 0	3.5 ± 0		3.4 ± 0		3.4 ± 0.1	
Total acidity	g/L	7.2 ± 0.1	6.9 ± 0.1	7.3 ± 0.1	6.9 ± 0.1	7.4 ± 0.1	6.9 ± 0.1	7.3 ± 0.1
Tartaric acid	g/L	2.6 ± 0.1	2.2 ± 0.1	2.7 ± 0.1	2.1 ± 0.0	2.7 ± 0.0	1.9 ± 0.1	2.5 ± 0.1
Malic acid	g/L	4.1 ± 0	4.0 ± 0.1		4.1 ± 0.1		4.1 ± 0.1	
Lactic Acid	g/L	0.4 ± 0.1	0.4 ± 0.1		0.4 ± 0.1		0.4 ± 0.1	
Volatile acidity	g/L	0.6 ± 0	0.6 ± 0		0.6 ± 0		0.6 ± 0.1	
Acetaldehyde	mg/L	na	24.5 ± 0.5	25.7 ± 1.6	23.7 ± 0.6	24.3 ± 0.7	24.3 ± 0.6	24.9 ± 0.5

[1] All the parameters were measured by FTIR analysis, except the acetaldehyde content, which was measured by the enzymatic method

[2] Values on the blue background: mean of all wine samples' variants stored at Cool conditions ± standard deviation

[3] Values on the yellow background: mean of all wine samples' variants stored at Warm conditions ± standard deviation

[4] Values on the white background: mean of all wine samples' variants stored at Cool and Warm conditions ± standard deviation

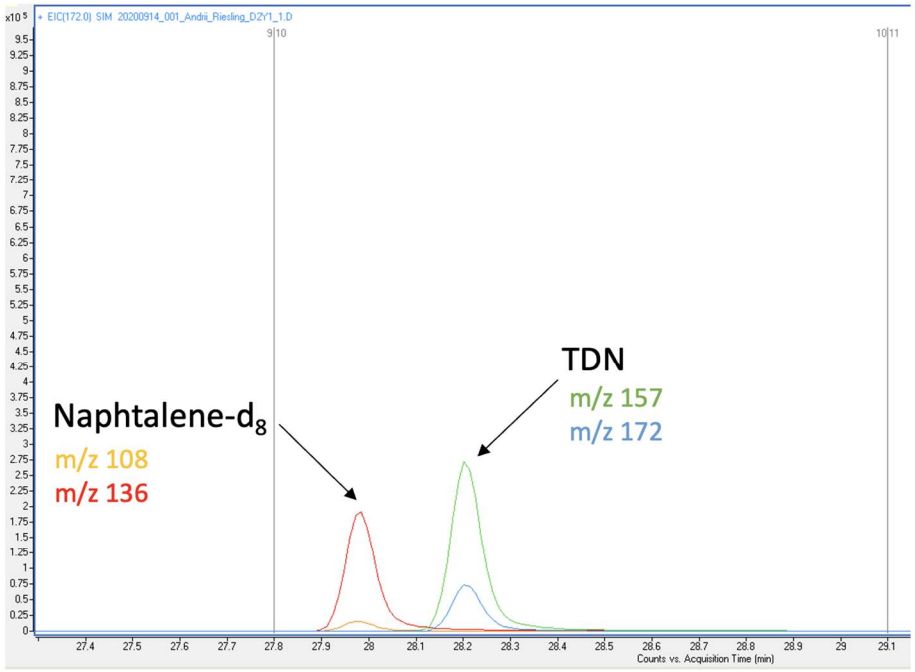
Supplementary Table S2. Concentration of the secondary wine aroma in the initial wine and after 24 months of storage

Group aromas	Aroma compound	Initial wines[1]	Wines after 24 months of storage[2]							
			High SO_2/no CO_2		*High SO_2/CO_2*		*Medium SO_2/CO_2*		*Low SO_2/CO_2*	
			Cool	**Warm**	**Cool**	**Warm**	**Cool**	**Warm**	**Cool**	**Warm**
Acetate esters	Isoamyl acetate, µg/L	3528 ± 319	983 ± 42	142 ± 12	873 ± 13	131 ± 9	1037 ± 80	146 ± 15	979 ± 39	134 ± 10
	2-Methylbutyl acetate, µg/L	166 ± 17	49 ± 3	21 ± 1	44 ± 0	20 ± 1	51 ± 5	20 ± 1	50 ± 2	20 ± 0
	Hexyl acetate, µg/L	221 ± 25	35 ± 6	nq	32 ± 3	nq	38 ± 7	nq	37 ± 5	nq
	2-Phenylethyl acetate, µg/L	299 ± 9	87 ± 11	25 ± 0	78 ± 2	24 ± 1	86 ± 6	25 ± 1	95 ± 6	24 ± 1
	Ethyl acetate, mg/L	117 ± 5	104 ± 3	102 ± 6	94 ± 1	101 ± 4	102 ± 7	105 ± 5	98 ± 3	98 ± 4
Ethyl esters	Ethyl propionate, µg/L	179 ± 17	381 ± 28	395 ± 22	343 ± 10	380 ± 18	388 ± 27	397 ± 9	384 ± 15	378 ± 14
	Ethyl butanoate, µg/L	695 ± 68	626 ± 16	598 ± 29	566 ± 19	578 ± 16	655 ± 41	599 ± 13	627 ± 24	565 ± 22
	Ethyl hexanoate, µg/L	1076 ± 163	1284 ± 120	1322 ± 79	1195 ± 43	1384 ± 40	1169 ± 22	1380 ± 36	1066 ± 74	1273 ± 62
	Ethyl octanoate, µg/L	1468 ± 160	1084 ± 224	1084 ± 111	1054 ± 114	1271 ± 5	910 ± 22	1207 ± 44	815 ± 152	1054 ± 81
	Ethyl decanoate, µg/L	515 ± 50	272 ± 71	188 ± 68	298 ± 72	255 ± 70	270 ± 53	232 ± 74	221 ± 41	186 ± 57
	Ethyl 2-methylpropanoate, µg/L	80 ± 11	156 ± 4	191 ± 13	150 ± 3	187 ± 4	169 ± 10	194 ± 4	160 ± 6	184 ± 8
	Ethyl 2-methylbutyrate, µg/L	na	25 ± 2	41 ± 2	24 ± 1	40 ± 1	28 ± 2	40 ± 1	26 ± 1	40 ± 1
	Ethyl 2-hydroxy-4-methylvalerate, µg/L	nq	132 ± 13	130 ± 2	125 ± 4	125 ± 7	139 ± 1	128 ± 5	144 ± 17	122 ± 2
	Ethyl phenylacetate, µg/L	nq	12 ± 1	13 ± 0	11 ± 0	12 ± 0	12 ± 1	13 ± 0	12 ± 1	13 ± 0
	Ethyl lactate, mg/L	29 ± 1	54 ± 5	52 ± 1	53 ± 1	49 ± 6	57 ± 3	49 ± 2	54 ± 3	45 ± 1
	Diethyl succinate, µg/L	1096 ± 18	4118 ± 130	6998 ± 153	3954 ± 75	6831 ± 83	4161 ± 114	7017 ± 92	4072 ± 264	6438 ± 119
Higher alcohols	*i*-Butanol, mg/L	33 ± 2	30 ± 3	32 ± 1	28 ± 1	30 ± 2	30 ± 2	30 ± 1	30 ± 0	30 ± 2
	Isoamyl alcohol, mg/L	162 ± 8	152 ± 11	162 ± 6	141 ± 8	161 ± 6	138 ± 6	161 ± 5	131 ± 9	152 ± 6
	2-Methyl-1-butanol, mg/L	30 ± 2	31 ± 1	31 ± 1	28 ± 1	30 ± 2	29 ± 2	30 ± 1	29 ± 1	30 ± 1
	Hexanol, µg/L	1152 ± 44	1672 ± 117	1567 ± 59	1512 ± 45	1456 ± 71	1664 ± 120	1534 ± 40	1713 ± 85	1497 ± 34
	2-Phenylethanol, mg/L	19 ± 0	24 ± 0	24 ± 1	22 ± 0	23 ± 1	23 ± 1	24 ± 0	24 ± 0	23 ± 0
Fatty acids	*i*-Valeric acid, µg/L	1717 ± 25	1237 ± 117	1102 ± 22	1338 ± 22	1053 ± 29	1378 ± 40	1104 ± 21	1390 ± 107	1085 ± 10
	Hexanoic acid, mg/L	12 ± 0	8 ± 1	8 ± 0	8 ± 0	7 ± 0	9 ± 0	7 ± 0	9 ± 1	7 ± 0
	Octanoic acid, mg/L	10 ± 0	8 ± 1	7 ± 0	7 ± 0	6 ± 0	8 ± 1	7 ± 1	8 ± 1	7 ± 1
	Decanoic acid, µg/L	2390 ± 270	1673 ± 439	1282 ± 81	1523 ± 156	1275 ± 136	1778 ± 343	1305 ± 109	1870 ± 330	1299 ± 118

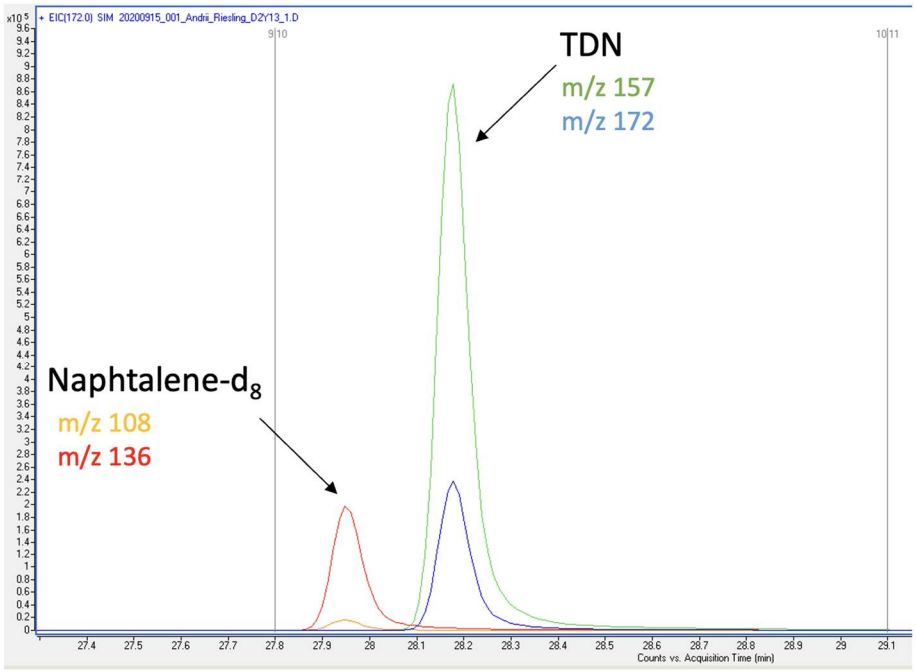
[1] Mean of three Riesling wines after the adjustment of Free SO_2 level (*High SO_2*, *Medium SO_2*, *Low SO_2*) ± standard deviation

[2] Mean of three samples with *Diam 5*, *Diam 30* and *Diam 30 origin* stoppers ± standard deviation

Supplementary Figure S1A. Extracted Ion Chromatogram: TDN and naphthalene-*d*$_8$ (internal standard)

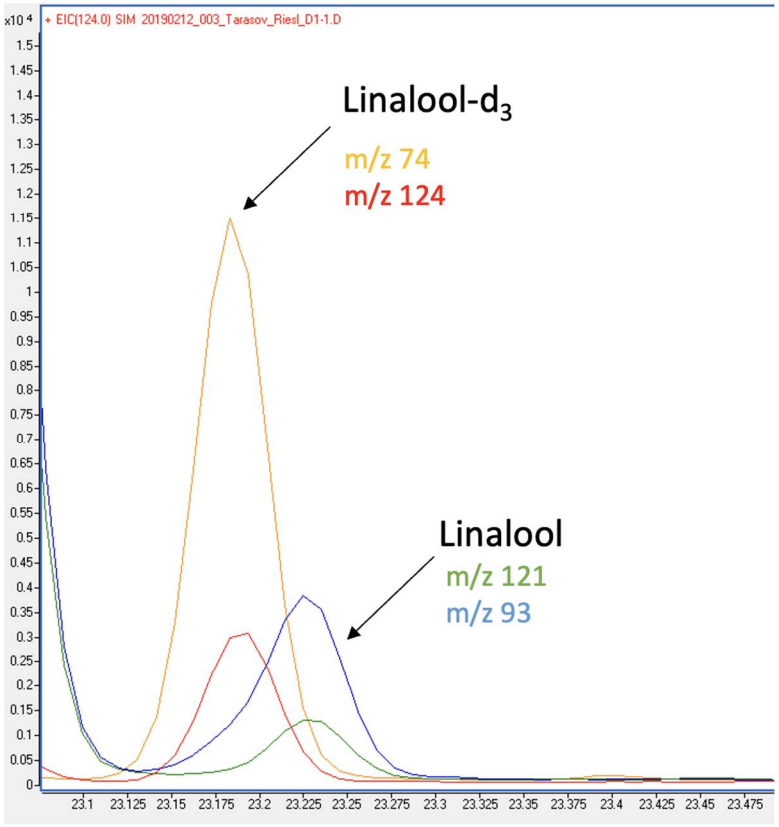


24 months: High SO_2/CO_2/Cool/Diam 5

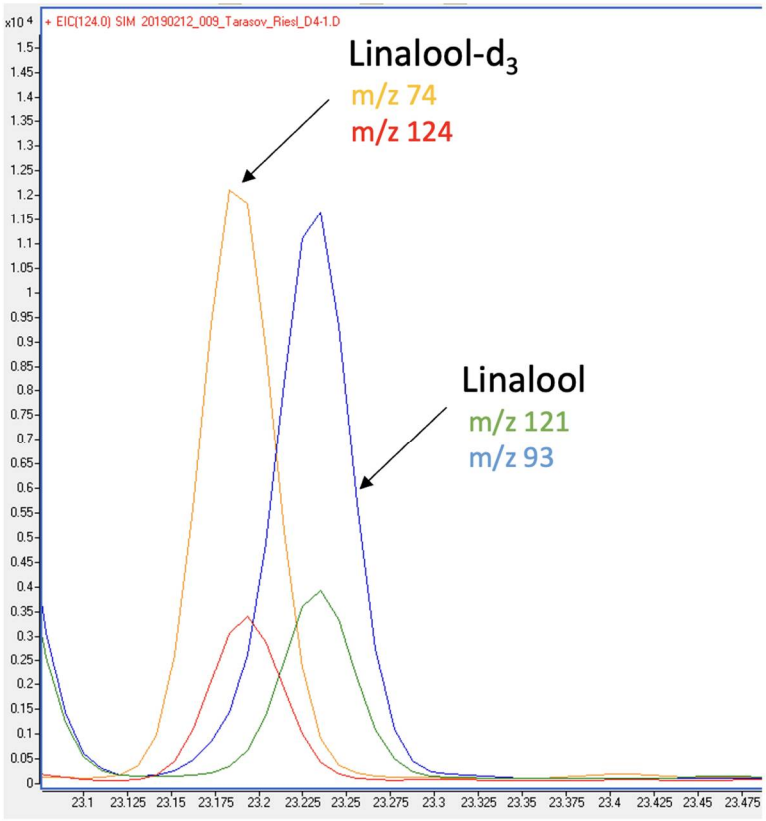


24 months: High SO_2/CO_2/Warm/Diam 5

Supplementary Figure S1B. Extracted Ion Chromatogram: linalool and linalool-*d*$_3$ (internal standard)

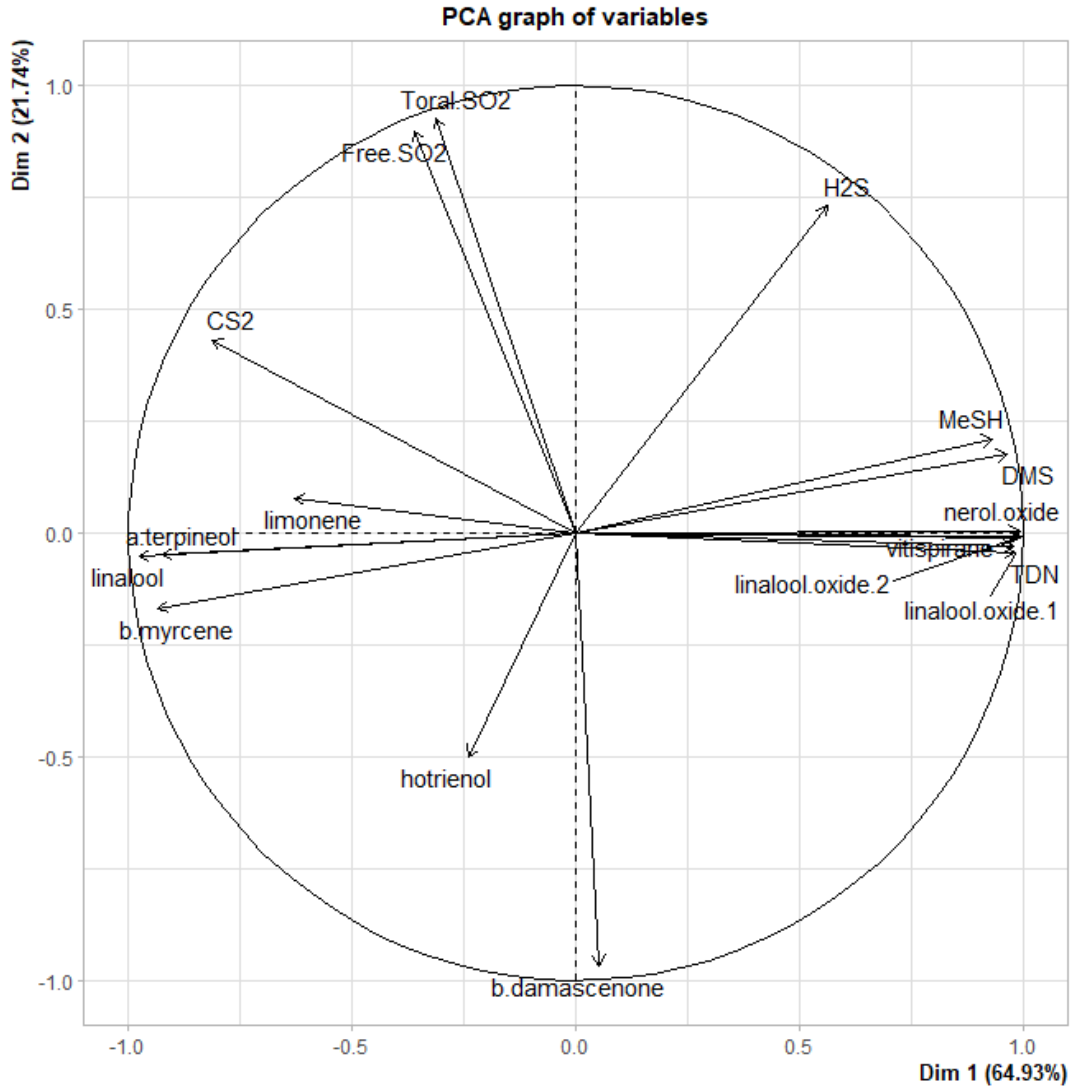


6 months: High SO_2/CO_2/Warm/Diam 5



6 months: High SO_2/CO_2/Cool/Diam 5

Supplementary Figure S2. Loadings plot for the PCA analysis of the wines after 24 months of storage: SO_2 content, terpenes and C_{13}-norisoprenoids (varietal aromas), LMWSCs



Supplementary Figure S3. Results of sensory analysis of the wines after 6, 12 and 24 months of storage: comparison of *Diam 5*, *Diam 30* and *Diam 30 origin* bottle stoppers effect in *ranking tests*

Bottling and storage conditions		6 Months. *Ranking tests*												12 Months. *Ranking tests*												24 Months. *Ranking tests*											
		High SO_2 / no CO_2			*High SO_2 / CO_2*			*Medium SO_2 / CO_2*			*Low SO_2 / CO_2*			*High SO_2 / no CO_2*			*High SO_2 / CO_2*			*Medium SO_2 / CO_2*			*Low SO_2 / CO_2*			*High SO_2 / no CO_2*			*High SO_2 / CO_2*			*Medium SO_2 / CO_2*			*Low SO_2 / CO_2*		
		Ranking (means)	Groups	Significance level	Ranking (means)	Groups	Significance level	Ranking (means)	Groups	Significance level	Ranking (means)	Groups	Significance level	Ranking (means)	Groups	Significance level	Ranking (means)	Groups	Significance level	Ranking (means)	Groups	Significance level	Ranking (means)	Groups	Significance level	Ranking (means)	Groups	Significance level	Ranking (means)	Groups	Significance level	Ranking (means)	Groups	Significance level	Ranking (means)	Groups	Significance level
Cool storage	*Diam 5*	2	a		1	b		3			2			3			2			1			2			1			3			2			2		
	Diam 30	2	a	*	3	a	*	1			1			1			3			3			1			2			1			3			1		
	Diam 30 or	1	b		2	b		2			1			2			1			2			3			3			2			1			2		
Warm storage	*Diam 5*	1			2			3			1			1			1			2			1			na											
	Diam 30	2			1			2			2			3			3			1			2														
	Diam 30 or	3			3			1			3			2			2			3			3														