

Supplemental Data for:

Boss, P.K., C. Böttcher, and C. Davies. 2014.

Various influences of harvest date and fruit sugar content on different wine flavor and aroma compounds.

Am. J. Enol. Vitic. 65:341-353. doi: 10.5344/ajev.2014.13137.

Supplemental Table 2 Volatile compounds in the headspace of the Riesling wines found to be significantly different ($p < 0.05$) due to Brix or harvest date. Abundances are presented as normalized values and cluster means are shown in italics at the beginning of each cluster group.

Compound	Harvest 1 / Brix category				Harvest 2 / Brix category				Harvest 3 / Brix category				Harvest 4 / Brix category				Descriptor ^a
	10-12	12-14	14-16	16-18	10-12	12-14	14-16	16-18	10-12	12-14	14-16	16-18	10-12	12-14	14-16	16-18	
Cluster 1	<i>0.88</i>	<i>0.90</i>	<i>0.89</i>	<i>0.80</i>	<i>0.89</i>	<i>0.88</i>	<i>0.86</i>	<i>0.72</i>	<i>0.88</i>	<i>0.77</i>	<i>0.80</i>	<i>0.75</i>	<i>0.88</i>	<i>0.91</i>	<i>0.89</i>	<i>0.91</i>	
Acetal	0.85	0.79	0.87	1	0.88	0.80	0.83	0.70	0.76	0.66	0.71	0.56	0.91	0.96	0.81	0.84	Ethereal
3-Methyl-1-pentanol	0.84	0.80	0.72	0.80	0.92	1	0.98	0.97	0.81	0.85	0.96	0.89	0.82	0.84	0.99	0.92	Fusel
1-Hexanol	0.83	0.88	0.93	0.95	0.87	0.92	1	0.96	0.81	0.83	0.94	0.97	0.86	0.94	0.97	1	Green
1-Octanol	0.78	0.78	0.91	1	0.80	0.80	0.82	0.84	0.71	0.73	0.76	0.77	0.77	0.81	0.86	0.90	Waxy, green
Phenylethyl alcohol	0.73	0.74	0.81	0.75	0.83	0.89	0.88	0.88	0.75	0.80	0.89	0.93	0.89	0.80	0.89	1	Floral
Ethyl acetate	0.93	0.95	0.97	0.87	0.85	0.79	0.79	0.70	1	0.78	0.79	0.75	0.76	0.94	0.76	0.77	Ethereal
Ethyl butanoate	0.99	1	0.97	0.75	1	0.95	0.87	0.64	0.99	0.86	0.86	0.77	0.94	0.97	0.91	0.89	Fruity
Ethyl 2-butenoate	0.96	0.99	0.91	0.66	0.96	0.90	0.76	0.55	0.94	0.77	0.75	0.65	0.91	1	0.91	0.88	Pungent
m-Cymene	0.95	0.97	0.82	0.57	1	0.92	0.83	0.53	0.98	0.83	0.86	0.69	0.92	0.97	0.85	0.99	Terpene
Ethyl heptanoate	0.77	0.84	0.91	0.76	0.63	0.67	0.87	0.73	0.88	0.69	0.84	0.76	0.84	0.87	0.98	1	Fruity
Ethyl 2-hexenoate	0.85	0.79	0.74	0.74	0.88	0.90	0.89	0.76	0.98	0.77	0.80	0.76	0.99	1	0.91	0.78	Fruity, green
2-Methylpropyl hexanoate	0.85	0.93	0.85	0.48	1	0.93	0.88	0.66	0.99	0.80	0.83	0.75	0.88	0.89	0.87	0.93	Sweet, estery
Heptyl acetate	0.76	0.85	0.74	0.70	0.76	0.75	0.76	0.56	1	0.75	0.83	0.77	0.79	0.87	0.84	0.89	Green
Isoamyl hexanoate	0.91	0.95	0.97	0.81	0.94	0.91	0.95	0.67	0.88	0.74	0.81	0.73	0.87	0.94	0.98	1	Fruit, banana
Hexyl hexanoate	1	0.97	0.94	0.68	0.99	0.98	0.96	0.52	0.82	0.73	0.86	0.76	0.81	0.97	0.99	0.95	Green
Ethyl 3-hydroxyhexanoate	1	0.95	0.87	0.92	0.95	0.85	0.76	0.71	0.96	0.78	0.76	0.75	0.89	0.88	0.74	0.76	Citrus, grape
Ethyl 3-hydroxytridecanoate	0.84	0.87	0.94	1	0.91	0.82	0.75	0.76	0.83	0.76	0.67	0.75	0.87	0.81	0.73	0.81	n/a
Hexanoic acid	1	0.96	0.99	0.89	0.87	0.86	0.83	0.75	0.79	0.74	0.68	0.70	0.81	0.82	0.81	0.76	Sour, fatty
Octanoic acid	0.85	0.87	0.98	1	0.85	0.86	0.89	0.84	0.79	0.78	0.73	0.76	0.88	0.91	0.90	0.87	Fatty
3-Methyl-1-butanol	0.89	0.91	0.91	0.83	0.90	0.91	0.94	0.98	0.93	0.95	1	0.95	0.92	0.95	1	0.96	Fusel
Ethyl hexanoate	0.89	0.98	0.88	0.71	0.97	1	0.84	0.62	0.97	0.75	0.73	0.71	0.99	0.96	1	0.92	Sweet, fruity
Ethyl octanoate	0.87	0.94	0.99	0.97	0.86	0.90	0.93	0.67	0.85	0.67	0.67	0.64	0.94	0.90	0.97	1	Fruity, wine
Ethyl decanoate	0.94	0.95	0.88	0.66	0.91	0.93	0.87	0.55	0.79	0.66	0.61	0.51	0.94	0.88	0.87	1	Sweet, waxy
Cluster 2	<i>0.53</i>	<i>0.55</i>	<i>0.76</i>	<i>0.92</i>	<i>0.55</i>	<i>0.59</i>	<i>0.67</i>	<i>0.73</i>	<i>0.55</i>	<i>0.59</i>	<i>0.65</i>	<i>0.71</i>	<i>0.58</i>	<i>0.67</i>	<i>0.68</i>	<i>0.80</i>	
Hexanal	0.54	0.41	0.63	0.78	0.33	0.41	0.61	0.50	0.46	0.38	0.68	0.35	0.51	1	0.69	0.77	Green
1,5,5,6-Tetramethyl-1,3-cyclohexadiene	0.70	0.65	0.94	1	0.68	0.69	0.71	0.76	0.77	0.71	0.70	0.70	0.67	0.67	0.60	0.72	n/a
2-Heptanol	0.44	0.60	0.93	1	0.70	0.69	0.79	0.80	0.63	0.60	0.73	0.76	0.65	0.82	0.80	0.99	Lemon
(E)-3-Hexen-1-ol	0.38	0.43	0.60	0.90	0.51	0.66	0.81	0.94	0.56	0.63	0.83	0.95	0.66	0.88	0.97	1	Green
1-Octen-3-ol	0.57	0.51	0.54	0.61	0.57	0.59	0.55	0.59	0.82	0.75	0.78	0.83	0.73	0.75	0.83	1	Mushroom
Linalool oxide	0.48	0.40	0.82	1	0.43	0.50	0.51	0.68	0.43	0.70	0.76	0.94	0.61	0.58	0.60	0.99	Floral
Nerol ethyl ether	0.40	0.40	0.75	0.92	0.39	0.47	0.54	0.62	0.38	0.59	0.72	0.79	0.50	0.60	0.60	1	n/a
2-Nonanol	0.46	0.61	0.88	1	0.57	0.57	0.64	0.68	0.55	0.53	0.52	0.51	0.55	0.58	0.56	0.66	Waxy
1-Nonanol	0.35	0.46	0.68	1	0.45	0.54	0.73	0.94	0.37	0.48	0.60	0.68	0.47	0.57	0.77	0.89	Floral
3-(Methylthio)-1-propanol	0.30	0.41	0.75	1	0.40	0.44	0.71	0.73	0.44	0.44	0.49	0.68	0.59	0.52	0.71	0.76	Sulfurous

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Supplemental Table 2 (continued) Volatile compounds in the headspace of the Riesling wines found to be significantly different ($p < 0.05$) due to Brix or harvest date. Abundances are presented as normalized values and cluster means are shown in italics at the beginning of each cluster group.

Compound	Harvest 1 / Brix category				Harvest 2 / Brix category				Harvest 3 / Brix category				Harvest 4 / Brix category				Descriptor ^a
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Cluster 2 (continued)																	
7-Methyl-3-methylene-6-octen-1-ol	0.43	0.52	0.50	0.94	0.52	0.62	0.75	0.86	0.49	0.56	0.63	0.76	0.53	0.71	0.76	1	n/a
(E)-3-Hexen-1-ol acetate	0.48	0.58	0.76	1	0.67	0.77	0.91	0.64	0.74	0.65	0.73	0.71	0.69	0.94	0.96	0.8	Fruity
trans Rose oxide	0.66	0.52	0.65	0.75	0.26	0.53	0.50	0.54	0.48	0.41	0.63	0.74	0.60	0.69	0.86	1	Floral
Nerol oxide	0.44	0.43	0.73	0.82	0.47	0.47	0.59	0.63	0.33	0.60	0.65	1	0.34	0.53	0.53	0.92	Green
m-Mentha-1,8-diene	0.50	0.56	0.81	1	0.51	0.55	0.61	0.65	0.50	0.60	0.51	0.66	0.49	0.47	0.41	0.59	n/a
(E)- <i>p</i> -Mentha-2,8-dien-1-ol	0.53	0.58	0.81	1	0.53	0.56	0.63	0.66	0.54	0.60	0.54	0.71	0.50	0.53	0.47	0.64	Mint
Ethyl nonanoate	0.61	0.69	0.85	1	0.62	0.60	0.74	0.64	0.62	0.58	0.63	0.56	0.54	0.63	0.66	0.72	Cognac
Ethyl 2-hydroxy-4-methylpentanoate	0.61	0.57	0.66	0.69	0.59	0.54	0.55	0.86	0.75	0.85	0.78	1	0.64	0.71	0.58	0.60	Blackberry
Nonyl acetate	0.48	0.60	0.84	1	0.51	0.59	0.74	0.45	0.48	0.43	0.49	0.45	0.49	0.63	0.72	0.85	Fruity
Ethyl 2-furoate	0.69	0.76	1	1	0.58	0.60	0.73	0.84	0.44	0.55	0.51	0.68	0.43	0.52	0.52	0.61	Fruity
Ethyl 3-methylbutyl succinate	0.53	0.59	0.81	1	0.65	0.58	0.66	0.80	0.44	0.54	0.63	0.53	0.48	0.56	0.62	0.64	n/a
Ethyl 3-hydroxytridecanoate	0.56	0.62	0.80	1	0.66	0.62	0.66	0.77	0.59	0.62	0.56	0.66	0.63	0.61	0.56	0.64	n/a
Nonanoic acid	0.65	0.62	0.83	1	0.65	0.58	0.62	0.76	0.56	0.62	0.49	0.54	0.59	0.51	0.63	0.72	Waxy
Decanoic acid	0.66	0.67	0.91	1	0.60	0.68	0.69	0.73	0.42	0.44	0.54	0.52	0.68	0.64	0.68	0.71	Fatty
3-Methyl-butanoic acid	0.64	0.60	0.74	0.68	0.68	0.70	0.70	0.90	0.73	0.82	0.89	1	0.74	0.82	0.80	0.80	Cheese
1-Heptanol	0.75	0.61	0.61	0.88	0.67	0.71	0.74	0.96	0.73	0.70	1	0.81	0.84	0.87	0.86	Leafy	
Cluster 3																	
3-Nonanone	0.35	0.41	0.39	0.58	0.46	0.53	0.56	0.54	0.41	0.49	0.66	0.77	0.45	0.55	0.74	1	
Linalool	0.45	0.41	0.45	0.54	0.49	0.55	0.56	0.41	0.37	0.46	0.61	0.69	0.36	0.50	0.67	1	Spicy
Hotrienol	0.26	0.32	0.33	0.42	0.3	0.39	0.39	0.36	0.3	0.41	0.67	0.76	0.41	0.54	0.76	1	Citrus
β -Citronellol	0.27	0.40	0.33	0.56	0.38	0.52	0.53	0.5	0.33	0.52	0.71	0.91	0.35	0.43	0.6	1	Tropical
3,7-Dimethyl-1,5-octadien-3,7-diol	0.40	0.54	0.47	0.74	0.61	0.67	0.77	0.81	0.56	0.59	0.75	0.81	0.63	0.65	0.81	1	Floral
Nerol	0.39	0.38	0.31	0.54	0.48	0.52	0.54	0.48	0.43	0.47	0.56	0.69	0.44	0.57	0.79	1	n/a
Cluster 4																	
2-Phenylethyl acetate	0.84	0.79	0.91	0.80	0.79	0.69	0.67	0.52	0.75	0.62	0.55	0.50	0.66	0.66	0.60	0.60	
Hexyl acetate	0.83	0.89	1	0.88	0.93	0.87	0.79	0.64	0.81	0.74	0.67	0.72	0.83	0.76	0.73	0.72	Floral
2-Heptanone	0.85	1	0.92	0.71	0.94	0.82	0.86	0.52	0.85	0.70	0.72	0.65	0.72	0.77	0.76	0.72	Green, fruity
1-Octen-3-one	0.81	0.73	1	0.60	0.63	0.56	0.56	0.45	0.52	0.49	0.49	0.46	0.65	0.67	0.52	0.61	Cheese
2,7-Dimethyl-1-octene	1	0.65	0.76	0.54	0.77	0.66	0.58	0.46	0.71	0.61	0.54	0.48	0.59	0.65	0.51	0.51	n/a
β -Isophorone	1	0.67	0.77	0.51	0.71	0.62	0.59	0.50	0.67	0.64	0.51	0.50	0.62	0.55	0.49	0.51	Peppermint
Benzaldehyde	1	0.68	0.91	0.79	0.70	0.66	0.65	0.67	0.76	0.64	0.51	0.54	0.63	0.64	0.52	0.56	Almond
2-Undecanone	0.87	0.67	1	0.85	0.72	0.73	0.84	0.69	0.53	0.58	0.61	0.52	0.62	0.56	0.58	0.63	Waxy

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Cluster 4 (continued)																	
β-Cyclocitral	1	0.70	0.92	0.76	0.78	0.70	0.64	0.60	0.60	0.62	0.48	0.48	0.53	0.53	0.44	0.44	Herbal
1-Ethoxy-1-methoxy- ethane	0.78	0.59	0.94	0.95	0.67	0.58	0.68	0.58	0.64	0.45	0.54	0.37	0.93	1	0.70	0.73	n/a
2,4,5-Trimethyl-1,3-dioxolane	0.87	0.67	1	0.89	0.80	0.64	0.68	0.48	0.75	0.44	0.65	0.31	0.91	0.85	0.70	0.73	n/a
1-Propanol	0.73	0.65	0.75	1	0.55	0.57	0.53	0.54	0.75	0.60	0.54	0.48	0.57	0.43	0.42	0.37	Fusel
Terpinen-4-ol	1	0.79	0.94	0.95	0.94	0.83	0.79	0.82	0.64	0.89	0.64	0.68	0.72	0.58	0.55	0.63	Woody
Propyl acetate	0.84	0.91	0.98	1	0.82	0.66	0.66	0.45	0.90	0.58	0.48	0.45	0.56	0.63	0.55	0.53	Solvent
2-Methylpropyl acetate	0.81	0.84	0.89	0.75	1	0.80	0.76	0.53	0.82	0.71	0.59	0.53	0.68	0.76	0.72	0.66	Sweet, fruity
Butyl acetate	0.61	0.72	1	0.86	0.60	0.54	0.53	0.32	0.69	0.48	0.47	0.41	0.54	0.63	0.57	0.53	Solvent
3-Methyl-1-butyl acetate	0.84	0.98	0.98	0.76	1	0.85	0.72	0.43	0.80	0.73	0.67	0.57	0.72	0.68	0.70	0.73	Banana
Pentyl acetate	0.82	0.92	1	0.90	0.77	0.73	0.74	0.48	0.81	0.66	0.52	0.58	0.60	0.76	0.70	0.70	Ethereal
Propyl hexanoate	0.98	0.96	0.88	0.72	0.95	0.75	0.78	0.49	1	0.71	0.64	0.52	0.69	0.74	0.72	0.66	Sweet, fruity
(E)-2-Hexenyl acetate	0.71	0.76	0.65	0.43	0.73	0.72	0.56	0.37	1	0.64	0.57	0.48	0.59	0.53	0.52	0.40	Leafy
4-Methyl-cyclohexene	0.87	1	0.95	0.72	0.91	0.71	0.71	0.49	0.94	0.70	0.64	0.54	0.76	0.80	0.75	0.70	Citrus
Octyl acetate	0.79	0.87	1	0.99	0.71	0.67	0.70	0.43	0.67	0.49	0.49	0.44	0.61	0.66	0.65	0.67	Green
Diethyl succinate	0.68	0.75	0.88	1	0.73	0.66	0.71	0.72	0.71	0.67	0.60	0.66	0.57	0.55	0.54	0.56	Mild fruity
Ethyl 2-hydroxyhexanoate	0.71	0.82	0.98	1	0.76	0.63	0.60	0.49	0.87	0.63	0.49	0.39	0.70	0.61	0.57	0.57	Green
Ethyl hexadecanoic acid	0.68	0.73	0.98	1	0.72	0.67	0.70	0.61	0.70	0.73	0.41	0.45	0.52	0.59	0.54	0.59	Waxy
Cluster 5																	
(Z)-2-Heptenal	1	0.59	0.46	0.29	0.50	0.31	0.22	0.14	0.47	0.22	0.14	0.12	0.35	0.24	0.17	0.15	
(Z)-3-Hexen-1-ol	1	0.55	0.62	0.37	0.54	0.42	0.27	0.14	0.47	0.26	0.15	0.15	0.41	0.28	0.24	0.24	Green
(Z)-3-Hexenyl acetate	1	0.62	0.41	0.30	0.50	0.29	0.22	0.18	0.46	0.24	0.18	0.13	0.36	0.26	0.17	0.13	Green
Cluster 6																	
Acetaldehyde	0.42	0.41	0.77	0.92	0.44	0.38	0.49	0.55	0.37	0.38	0.35	0.39	0.37	0.39	0.37	0.43	
Nonanal	0.84	0.56	1	0.60	0.61	0.47	0.46	0.28	0.46	0.36	0.41	0.33	0.44	0.44	0.30	0.55	Pungent
β-Damascenone	0.42	0.41	1	0.73	0.54	0.44	0.42	0.54	0.29	0.39	0.34	0.31	0.42	0.42	0.31	0.38	Waxy
β-Ionone	0.37	0.37	0.83	1	0.44	0.46	0.58	0.74	0.41	0.46	0.39	0.52	0.49	0.52	0.42	0.52	Sweet, fruity
Nerolidol	0.66	0.61	0.83	1	0.62	0.54	0.58	0.61	0.45	0.39	0.35	0.36	0.40	0.35	0.29	0.33	Floral
Vitispirane I	0.23	0.20	0.54	1	0.15	0.19	0.58	0.86	0.24	0.42	0.37	0.55	0.32	0.25	0.36	0.42	Floral, green
Methyl decanoate	0.55	0.36	1	0.82	0.63	0.40	0.46	0.78	0.27	0.55	0.35	0.49	0.34	0.35	0.24	0.26	Floral
β-Citronellyl acetate	0.29	0.41	0.93	1	0.35	0.30	0.38	0.42	0.48	0.31	0.23	0.29	0.29	0.39	0.38	0.38	Oily
Ethyl 9-decanoate	0.25	0.41	0.55	1	0.38	0.38	0.50	0.39	0.33	0.28	0.29	0.27	0.32	0.36	0.42	0.46	Floral, green
Nerol acetate	0.40	0.41	0.49	1	0.34	0.37	0.44	0.59	0.39	0.39	0.53	0.44	0.42	0.43	0.40	0.43	Fruity, fatty
Geranyl acetate	0.21	0.37	0.57	1	0.38	0.24	0.47	0.46	0.31	0.33	0.28	0.36	0.28	0.34	0.39	0.46	Floral

^aDescriptors are obtained from "The Good Scents Company" website (<http://www.thegoodscentscopy.com/index.html>). n/a = not available.