

Supplemental Data for:

Previtali P, Giorgini F, Sanchez LA and Dokoozlian NK. 2026. Long-term weather observations reveal the impact of heatwaves on the yield and fruit composition of Cabernet Sauvignon. *Am J Enol Vitic* 77:0770001. DOI: 10.5344/ajev.2025.25017

Supplemental Table 1 List of summary features extracted from PRISM long-term weather observations. GDD, growing degree day; T_{max} , maximum temperature; HWU, heatwave units; DOY, day of year; T_{mean} , mean temperature; T_{min} , minimum temperature; VPD, vapor pressure deficit.

Feature number	Feature name	Short description
1	GDD_march	Sum of GDD in March
2	GDD_april	Sum of GDD in April
3	GDD_may	Sum of GDD in May
4	GDD_june	Sum of GDD in June
5	GDD_july	Sum of GDD in July
6	GDD_aug	Sum of GDD in August
7	GDD_sep	Sum of GDD in September
8	GDD_oct	Sum of GDD in October
9	GDD_preV	Sum of GDD May to July
10	GDD_postV	Sum of GDD August to October
11	GDD_Apr_Oct	Seasonal GDD (April to October)
12	Tmax_jan	T_{max} in January
13	Tmax_feb	T_{max} in February
14	Tmax_march	T_{max} in March
15	Tmax_april	T_{max} in April
16	Tmax_may	T_{max} in May
17	Tmax_june	T_{max} in June
18	Tmax_july	T_{max} in July
19	Tmax_aug	T_{max} in August
20	Tmax_sep	T_{max} in September
21	Tmax_oct	T_{max} in October
22	Tmax_nov	T_{max} in November
23	Tmax_dec	T_{max} in December
24	Tmax_preV	T_{max} May to July
25	Tmax_postV	T_{max} Aug to Oct
26	Tmax_Apr_Oct	Seasonal T_{max} (April to October)
27	Tmax_doy	DOY with T_{max}
28	HWU_may	Sum of HWU in May
29	HWU_june	Sum of HWU in June
30	HWU_july	Sum of HWU in July
31	HWU_aug	Sum of HWU in August
32	HWU_sep	Sum of HWU in September
33	HWU_preV	Sum of HWU May to July
34	HWU_postV	Sum of HWU August to October
35	HWU_Apr_Oct	Seasonal HWU (April to October)
36	ppt_jan	Precipitation in January
37	ppt_feb	Precipitation in February
38	ppt_march	Precipitation in March
39	ppt_april	Precipitation in April
40	ppt_may	Precipitation in May
41	ppt_june	Precipitation in June
42	ppt_july	Precipitation in July
43	ppt_aug	Precipitation in August
44	ppt_sep	Precipitation in September
45	ppt_oct	Precipitation in October
46	ppt_nov	Precipitation in November
47	ppt_dec	Precipitation in December
48	ppt_preS	Preseason precipitation (January to March)
49	ppt_preV	Precipitation May to July
50	ppt_postV	Precipitation August to October

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Feature number	Feature name	Short description
51	ppt_Apr_Oct	Seasonal precipitation (April to October)
52	ppt_max_doy	DOY with max precipitation
53	tmean_jan	T_{mean} in January
54	tmean_feb	T_{mean} in February
55	tmean_march	T_{mean} in March
56	tmean_apr	T_{mean} in April
57	tmean_may	T_{mean} in May
58	tmean_june	T_{mean} in June
59	tmean_july	T_{mean} in July
60	tmean_aug	T_{mean} in August
61	tmean_sep	T_{mean} in September
62	tmean_oct	T_{mean} in October
63	tmean_nov	T_{mean} in November
64	tmean_dec	T_{mean} in December
65	tmean_preS	T_{mean} May to July
66	tmean_preV	T_{mean} August to Oct
67	tmean_postV	Seasonal T_{mean} (April to October)
68	tmean_Apr_Oct	DOY with T_{mean}
69	tmin_jan	T_{min} in January
70	tmin_feb	T_{min} in February
71	tmin_march	T_{min} in March
72	tmin_apr	T_{min} in April
73	tmin_may	T_{min} in May
74	tmin_june	T_{min} in June
75	tmin_july	T_{min} in July
76	tmin_aug	T_{min} in August
77	tmin_sep	T_{min} in September
78	tmin_oct	T_{min} in October
79	tmin_nov	T_{min} in November
80	tmin_dec	T_{min} in December
81	tmin_preS	T_{min} preseason (January to March)
82	tmin_preV	T_{min} May to July
83	tmin_postV	T_{min} August to October
84	tmin_Apr_Oct	Seasonal T_{min} (April to October)
85	fdays_jan	Frost days in January
86	fdays_feb	Frost days in February
87	fdays_mar	Frost days in March
88	fdays_apr	Frost days in April
89	fdays_may	Frost days in May
90	fdays_oct	Frost days in October
91	fdays_nov	Frost days in November
92	fdays_dec	Frost days in December
93	fdays_Apr_Oct	Seasonal frost days (April to October)
94	frost_jan	Frost degrees in January
95	frost_feb	Frost degrees in February
96	frost_march	Frost degrees in March
97	frost_apr	Frost degrees in April
98	frost_may	Frost degrees in May
99	frost_nov	Frost degrees in November

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Feature number	Feature name	Short description
100	frost_dec	Frost degrees in December
101	vpdmin_jan	Min VPD in January
102	vpdmin_feb	Min VPD in February
103	vpdmin_march	Min VPD in March
104	vpdmin_apr	Min VPD in April
105	vpdmin_may	Min VPD in May
106	vpdmin_june	Min VPD in June
107	vpdmin_july	Min VPD in July
108	vpdmin_aug	Min VPD in August
109	vpdmin_sep	Min VPD in September
110	vpdmin_oct	Min VPD in October
111	vpdmin_nov	Min VPD in November
112	vpdmin_dec	Min VPD in December
113	vpdmin_preV	Min VPD (April to July)
114	vpdmin_postV	Min VPD (August to Oct)
115	vpdmin_Apr_Oct	Seasonal Min VPD (April to October)
116	vpdmax_jan	Max VPD in January
117	vpdmax_feb	Max VPD in February
118	vpdmax_march	Max VPD in March
119	vpdmax_apr	Max VPD in April
120	vpdmax_may	Max VPD in May
121	vpdmax_june	Max VPD in June
122	vpdmax_july	Max VPD in July
123	vpdmax_aug	Max VPD in August
124	vpdmax_sep	Max VPD in September
125	vpdmax_oct	Max VPD in October
126	vpdmax_nov	Max VPD in November
127	vpdmax_dec	Max VPD in December
128	vpdmax_preV	Max VPD (April to July)
129	vpdmax_postV	Max VPD (August to October)
130	vpdmax_Apr_Oct	Seasonal Min VPD (April to October)
131	heat_days_100	Heat days base 38°C
132	heat_days_june	Heat days in June
133	heat_days_july	Heat days in July
134	heat_days_aug	Heat days in August
135	heat_days_sep	Heat days in September
136	heat_days_preV	Heat days May to July
137	heat_days_postV	Heat days August to October
138	no_hw_june	Number of heatwaves in June
139	no_hw_july	Number of heatwaves in July
140	no_hw_aug	Number of heatwaves in August
141	no_hw_sep	Number of heatwaves in September
142	no_hw_preV	Number of heatwaves May to July
143	no_hw_postV	Number of heatwaves August to October
144	no_hw	Seasonal number of heatwaves
145	avg_hw_duration	Average heatwave duration (days)
146	max_hw_duration	Maximum heatwave duration (days)
147	tot_hw_hwu	Total heatwave HWU
148	avg_hw_hwu	Average heatwave HWU

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Feature number	Feature name	Short description
149	avg_hw_vpd	Average heatwave VPD
150	max_hw_vpd	Maximum heatwave VPD
151	hw_hwu_june	Heatwave HWU in June
152	hw_hwu_july	Heatwave HWU in July
153	hw_hwu_aug	Heatwave HWU in August
154	hw_hwu_sep	Heatwave HWU in September
155	hw_hwu_preV	Heatwave HWU May to July
156	hw_hwu_postV	Heatwave HWU August to October
157	Tmax_BBtoBL	T_{max} from budbreak to bloom
158	Tmax_BLtoVER	T_{max} from bloom to veraison
159	Tmax_VERtoH	T_{max} from veraison to harvest
160	Tmax_BBtoH	T_{max} from budbreak to harvest
161	Tmean_BBtoBL	T_{mean} from budbreak to bloom
162	Tmean_BLtoVER	T_{mean} from bloom to veraison
163	Tmean_VERtoH	T_{mean} from veraison to harvest
164	Tmean_BBtoH	T_{mean} from budbreak to harvest
165	Tmin_BBtoBL	T_{min} from budbreak to bloom
166	Tmin_BLtoVER	T_{min} from bloom to veraison
167	Tmin_VERtoH	T_{min} from veraison to harvest
168	Tmin_BBtoH	T_{min} from budbreak to harvest
169	rain_BBtoBL	Precipitation from budbreak to bloom
170	rain_BLtoVER	Precipitation from bloom to veraison
171	rain_VERtoH	Precipitation from veraison to harvest
172	rain_BBtoH	Precipitation from budbreak to harvest
173	fdays_BBtoBL	Frost days from budbreak to bloom
174	fdays_BLtoVER	Frost days from bloom to veraison
175	fdays_VERtoH	Frost days from veraison to harvest
176	fdays_BBtoH	Frost days from budbreak to harvest
177	frost_BBtoBL	Frost degrees from budbreak to bloom
178	frost_BLtoVER	Frost degrees from bloom to veraison
179	frost_VERtoH	Frost degrees from veraison to harvest
180	frost_BBtoH	Frost degrees from budbreak to harvest
181	hwu_BBtoBL	HWU from budbreak to bloom
182	hwu_BLtoVER	HWU from bloom to veraison
183	hwu_VERtoH	HWU from veraison to harvest
184	hwu_BBtoH	HWU from budbreak to harvest
185	vpdmax_BBtoBL	VPD_{max} from budbreak to bloom
186	vpdmax_BLtoVER	VPD_{max} from bloom to veraison
187	vpdmax_VERtoH	VPD_{max} from veraison to harvest
188	vpdmax_BBtoH	VPD_{max} from budbreak to harvest
189	vpdavg_BBtoBL	VPD_{avg} from budbreak to bloom
190	vpdavg_BLtoVER	VPD_{avg} from bloom to veraison
191	vpdavg_VERtoH	VPD_{avg} from veraison to harvest
192	vpdavg_BBtoH	VPD_{avg} from budbreak to harvest
193	vpdmin_BBtoBL	VPD_{min} from budbreak to bloom
194	vpdmin_BLtoVER	VPD_{min} from bloom to veraison
195	vpdmin_VERtoH	VPD_{min} from veraison to harvest
196	vpdmin_BBtoH	VPD_{min} from budbreak to harvest
197	no_hw_BLtoVER	Number of heatwaves from bloom to veraison

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Feature number	Feature name	Short description
198	no_hw_VERtoH	Number of heatwaves from veraison to harvest
199	no_hw_BBtoH	Number of heatwaves from budbreak to harvest
200	avg_hw_duration_BLtoVER	Average heatwave duration from bloom to veraison
201	avg_hw_duration_VERtoH	Average heatwave duration from veraison to harvest
202	avg_hw_duration_BBtoH	Average heatwave duration from budbreak to harvest
203	max_hw_duration_BLtoVER	Maximum heatwave duration from bloom to veraison
204	max_hw_duration_VERtoH	Maximum heatwave duration from veraison to harvest
205	max_hw_duration_BBtoH	Maximum heatwave duration from budbreak to harvest
206	tot_hw_hwu_BLtoVER	Total heatwave HWU from bloom to veraison
207	tot_hw_hwu_VERtoH	Total heatwave HWU from veraison to harvest
208	tot_hw_hwu_BBtoH	Total heatwave HWU from budbreak to harvest
209	avg_hw_hwu_BLtoVER	Average heatwave HWU from bloom to veraison
210	avg_hw_hwu_VERtoH	Average heatwave HWUs from veraison to harvest
211	avg_hw_hwu_BBtoH	Average heatwave HWUs from budbreak to harvest
212	avg_hw_vpd_BLtoVER	Average heatwave VPD from bloom to veraison
213	avg_hw_vpd_VERtoH	Average heatwave VPD from veraison to harvest
214	avg_hw_vpd_BBtoH	Average heatwave VPD from budbreak to harvest
215	max_hw_vpd_BLtoVER	Maximum heatwave VPD from bloom to veraison
216	max_hw_vpd_VERtoH	Maximum heatwave VPD from veraison to harvest
217	max_hw_vpd_BBtoH	Maximum heatwave VPD from budbreak to harvest
218	heat_days_BLtoVER	Number of heat days from bloom to veraison
219	heat_days_VERtoH	Number of heat days from veraison to harvest
220	heat_days_BBtoH	Number of heat days from budbreak to harvest

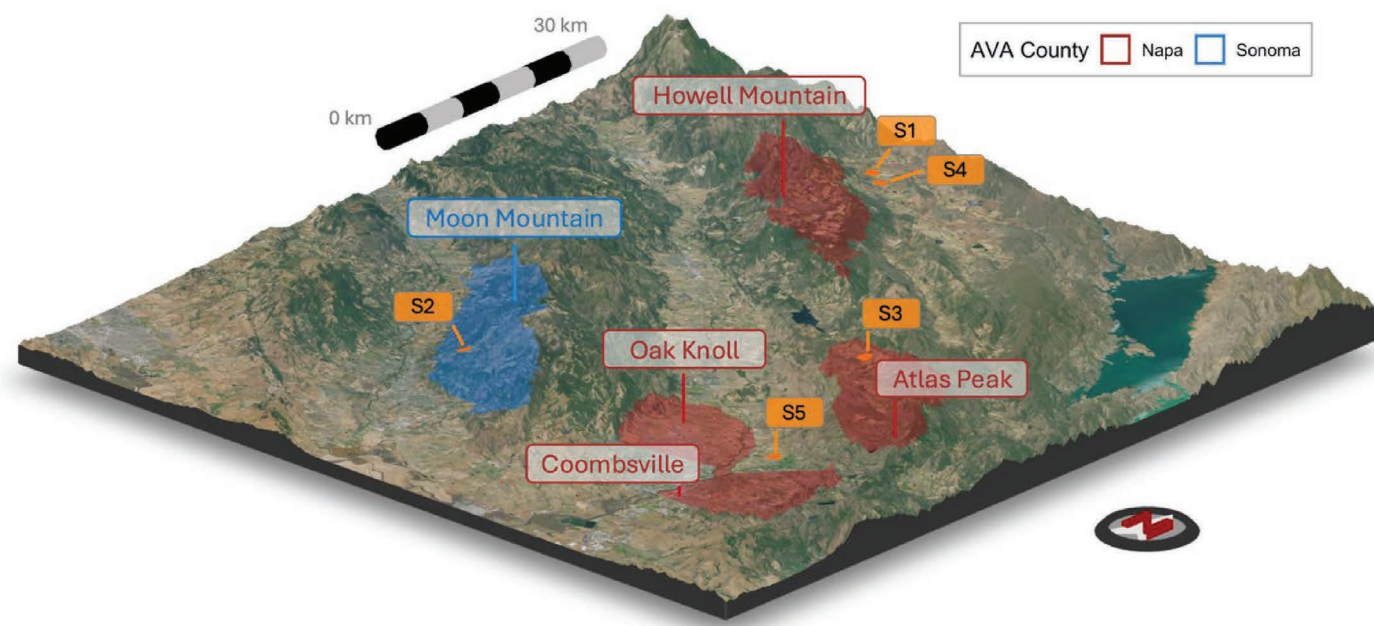
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	C1	C2	C3	p value	C1-C2	C1-C3	C2-C3
Supplemental Table 2 Statistical outputs of harvest date, yield, and fruit composition parameters by cluster (C1, cluster 1, postveraison heat; C2, cluster 2, preveraison heat; C3, cluster 3, cool season). <i>P</i> values of cluster effects were computed using linear mixed models (fixed effect: cluster; random effect: vineyard block ID). Data by cluster are presented as means ± 95% confidence intervals and different letters denote significant differences between means according to Tukey's adjusted post-hoc test at $p \leq 0.05$. Significant <i>p</i> values (i.e., ≤ 0.05) are marked in bold formatting. DOY, day of year; TSS, total soluble solids; YAN, yeast assimilable nitrogen; IBMP, 3-isobutyl-2-methoxypyrazine.							
Vineyard performance							
Harvest date (DOY)	274 (272-275) c	277 (276-279) b	291 (290-292) a	<0.0001	<0.0001	<0.0001	<0.0001
Yield (tons/ha)	5.48 (5.40-5.55) b	5.03 (4.95-5.11) c	6.97 (6.89-7.04) a	<0.0001	0.0102	<0.0001	<0.0001
Berry chemistry							
Berry moisture (%)	69.6 (69.5-69.6)	69.9 (69.8-70.0)	69.8 (69.7-69.9)	0.299	0.3428	0.4232	0.9652
TSS (Brix)	26.4 (26.4-26.45) a	26.0 (25.9-26.0) b	26.1 (26.0-26.1) b	0.0001	0.0003	0.0023	0.6664
pH	3.65 (3.65-3.65) a	3.57 (3.56-3.57) c	3.61 (3.61-3.62) b	<0.0001	<0.0001	<0.0001	<0.0001
Malic acid (mg/L)	1995 (1980-2011) a	1341 (1324-1359) b	1349 (1333-1364) b	<0.0001	<0.0001	<0.0001	0.9841
YAN (mg/L)	93.6 (92.4-94.9) b	65.6 (64.1- 67.0) c	123.8 (122.6-125.0) a	<0.0001	<0.0001	<0.0001	<0.0001
Phenolic compounds							
Total anthocyanins (mg/g)	1.50 (1.49-1.51) c	1.85 (1.84-1.86) a	1.75 (1.74-1.76) b	<0.0001	<0.0001	<0.0001	<0.0001
Polymeric tannins (mg/L)	3856 (3837-3875) a	3447 (3426-3467) b	2979 (2961-2998) c	<0.0001	<0.0001	<0.0001	<0.0001
Quercetin glycosides (mg/L)	118 (117-119) b	146 (144-147) a	118 (117-120) b	<0.0001	<0.0001	0.9923	<0.0001
Aroma compounds							
1-Octen-3-ol (µg/L)	50.2 (49.5-50.9) a	27.8 (27.0-28.6) b	17.1 (16.4-17.7) c	<0.0001	<0.0001	<0.0001	<0.0001
β-Damascenone (µg/L)	53.5 (53.2-53.8) b	52.7 (52.3-53.1) b	56.9 (56.6-57.2) a	<0.0001	0.5893	<0.0001	<0.0001
C6 compounds (µg/L)	5424 (5361-5488)	5353 (5197-5509)	5170 (5107-5233)	0.3712	0.859	0.3426	0.977
IBMP (ng/L)	2.71 (2.59-2.82) c	5.68 (5.55-5.81) a	4.14 (4.03-4.25) b	<0.0001	<0.0001	<0.0001	<0.0001

Supplemental Data for:

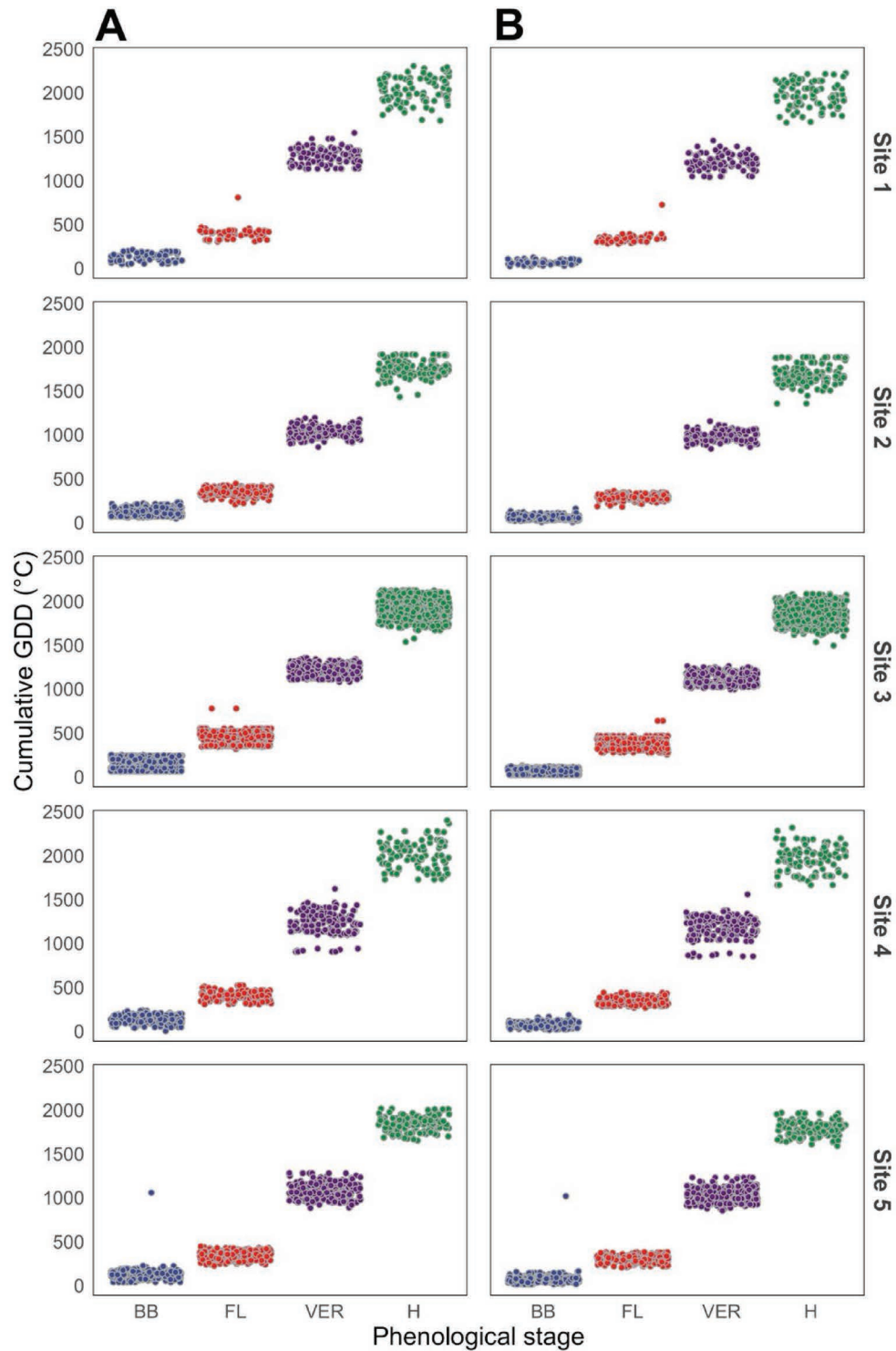
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Supplemental Figure 1 Map of vineyard site (S1 to S5) locations and closest American Viticultural Areas (AVA).

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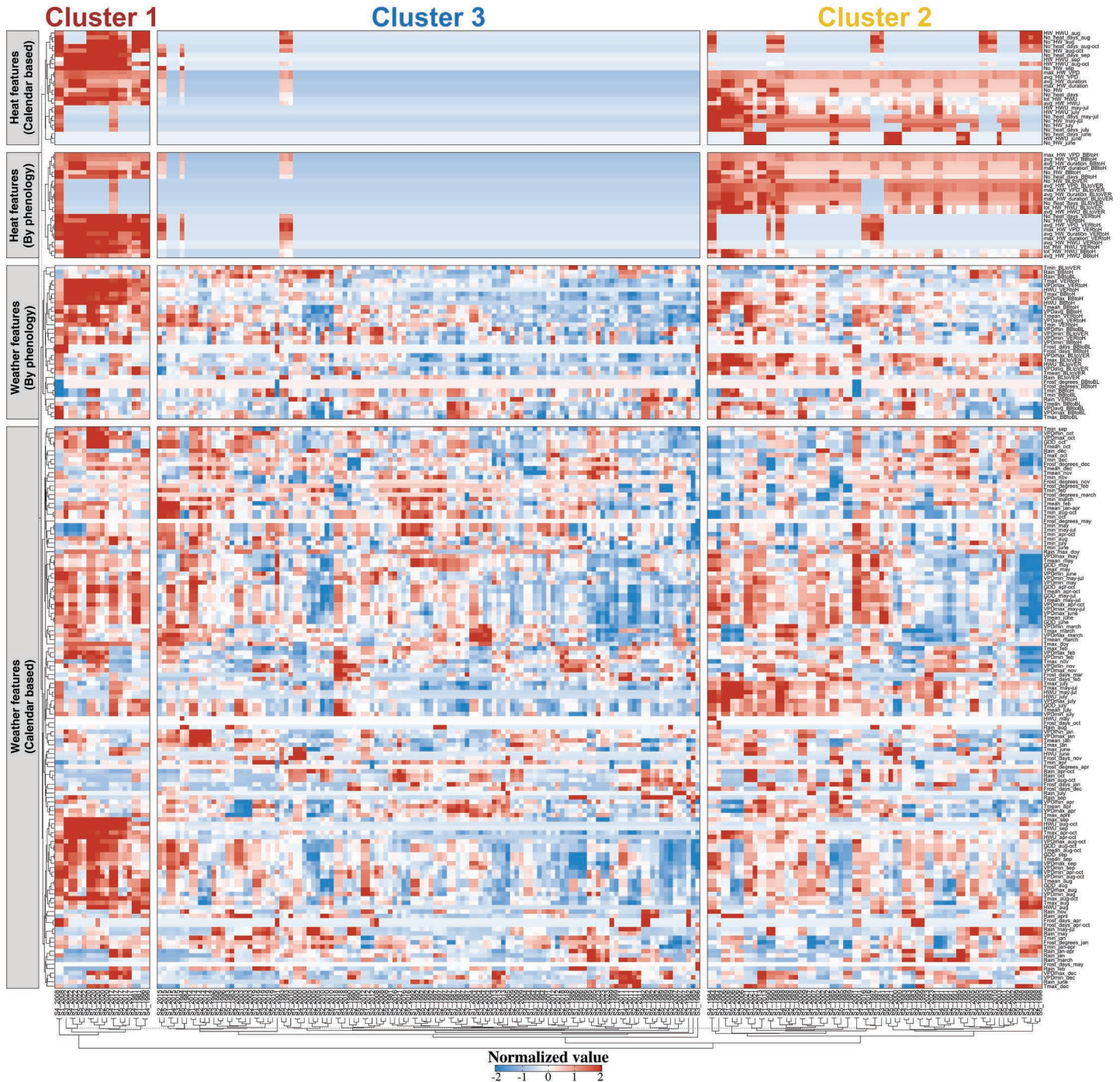
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Supplemental Figure 2 Relationships between observed phenological stages (BB, budbreak; FL, flowering; VER, veraison; H, harvest) and cumulative growing degree day (GDD) calculated from **A**) 1 January or **B**) 1 March. Cumulative GDD were calculated using PRISM daily data.

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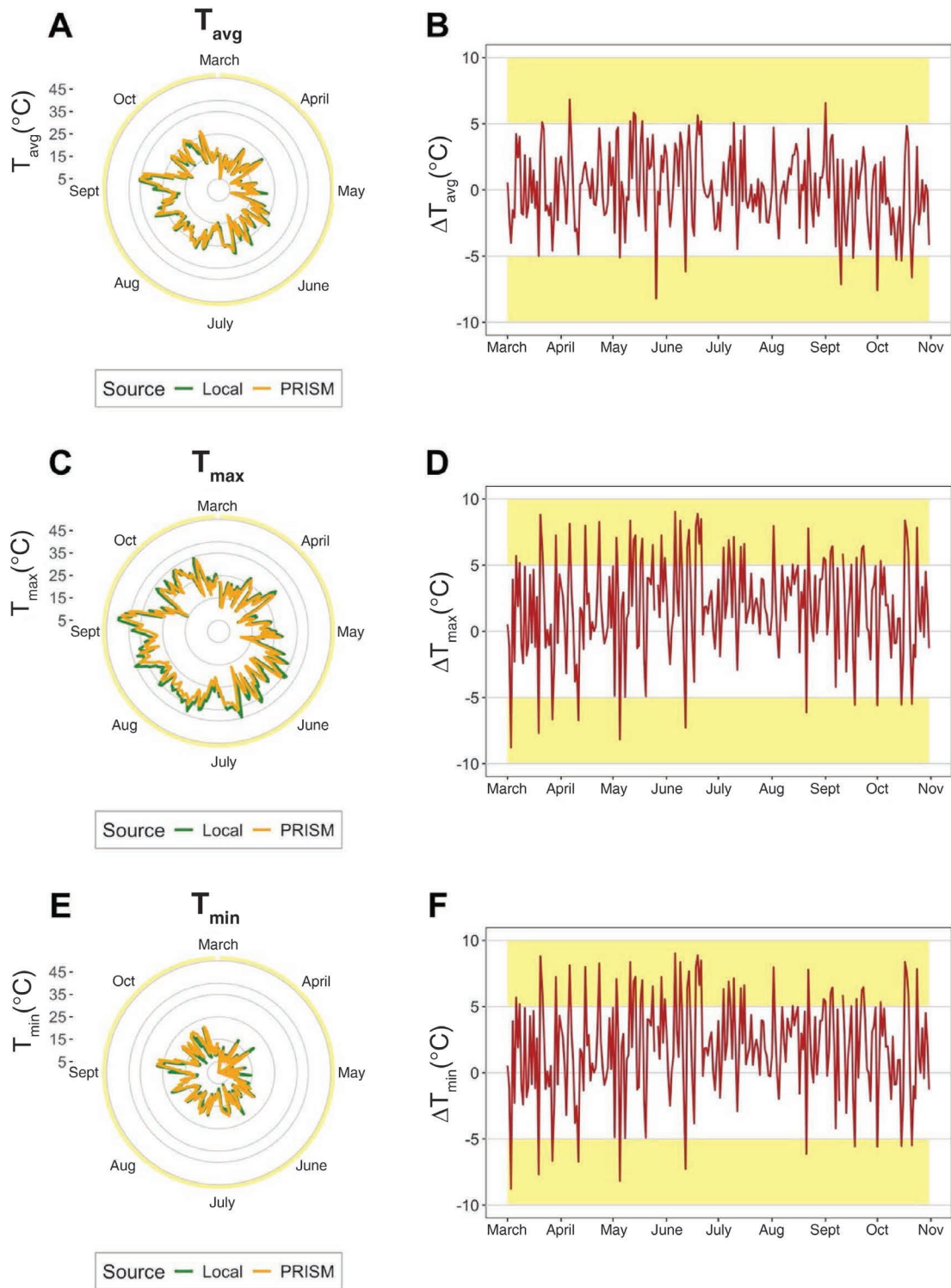


Supplemental Figure 3 Heatmap of scaled historical weather data submitted to clustering analysis. Columns represent combinations of a vineyard site (S1 to S5) and season (1981 to 2023), rows show normalized values (mean = 0, standard deviation = 1) for each weather feature extracted from historical series. Dendrograms group rows and columns using hierarchical clustering analysis. Gray boxes represent categories of features (generic weather and heat-related) and specify whether growth stages were based on calendar days or phenological stages.

See additional Data Supplement for full-sized graphic.

Supplemental Data for:

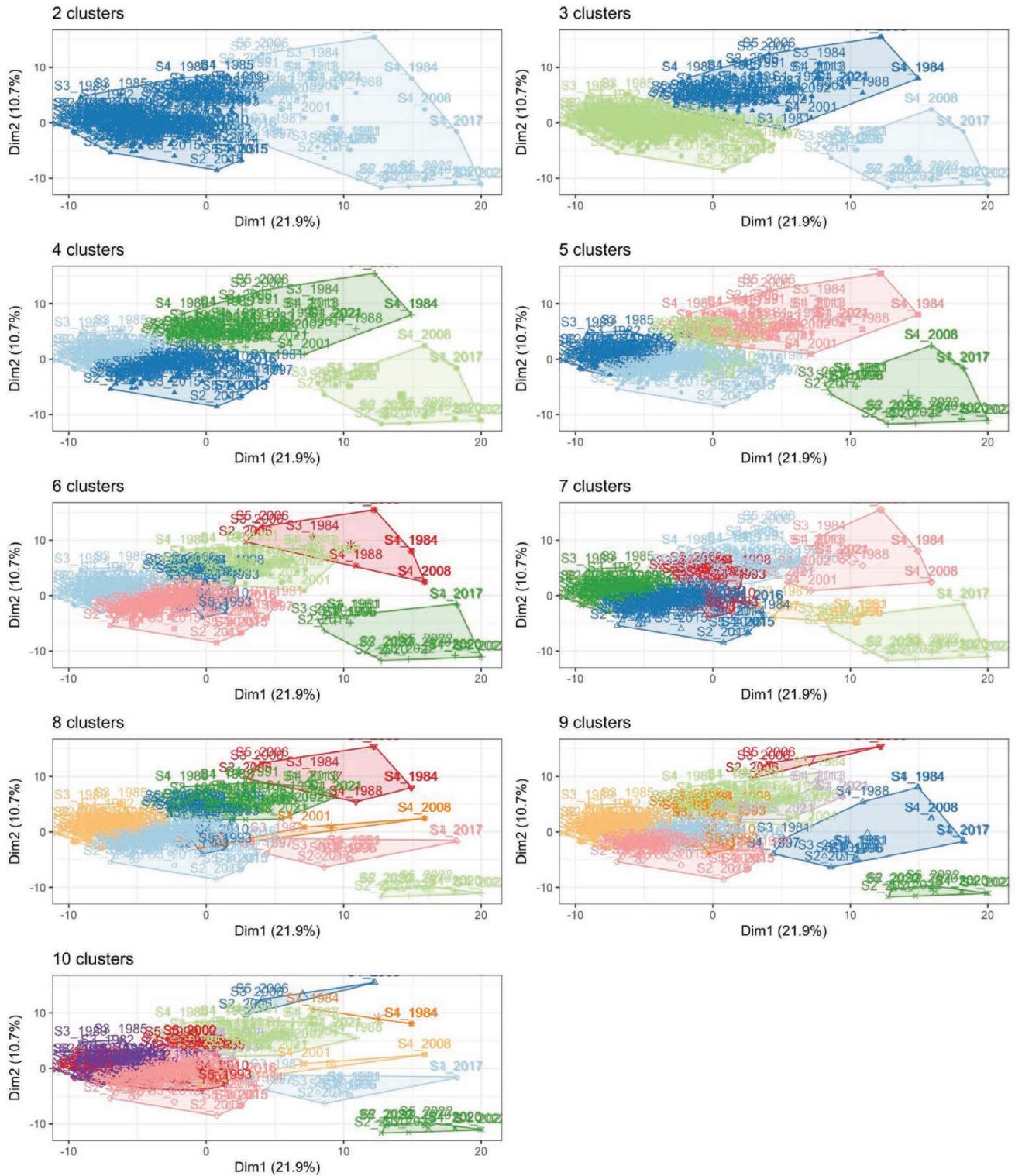
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Supplemental Figure 4 Comparison between daily temperature values from PRISM (gridded climate data) and a local weather station at one of the study sites (April to October): average (T_{avg} ; **A** and **B**), maximum (T_{max} ; **C** and **D**), and minimum temperature (T_{min} ; **E** and **F**). In **A**, **C**, and **E**, lines connect daily temperature values and colors differentiate between data sources. **B**, **D**, and **F** show daily differences between PRISM and local station data.

Supplemental Data for:

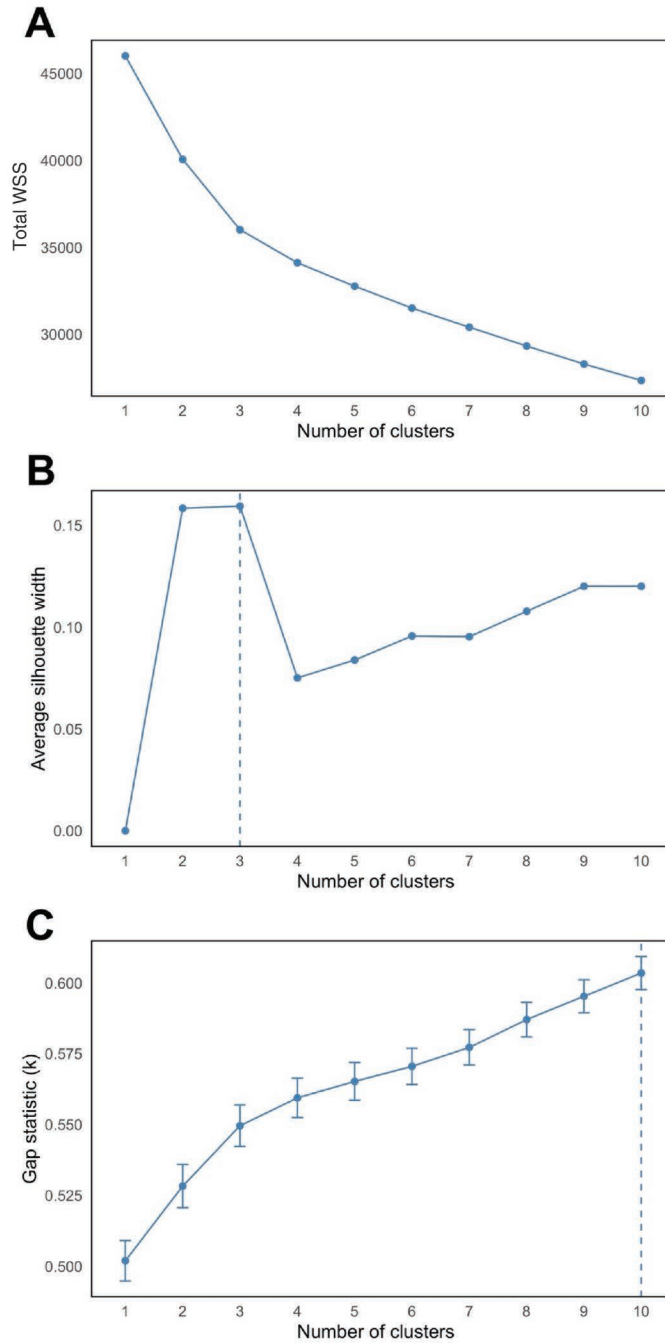
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Supplemental Figure 5 Hierarchical clustering analysis outputs by varying number of clusters from 2 to 10 clusters. The three-cluster solution was selected as the optimal number of clusters for further analysis.

Supplemental Data for:

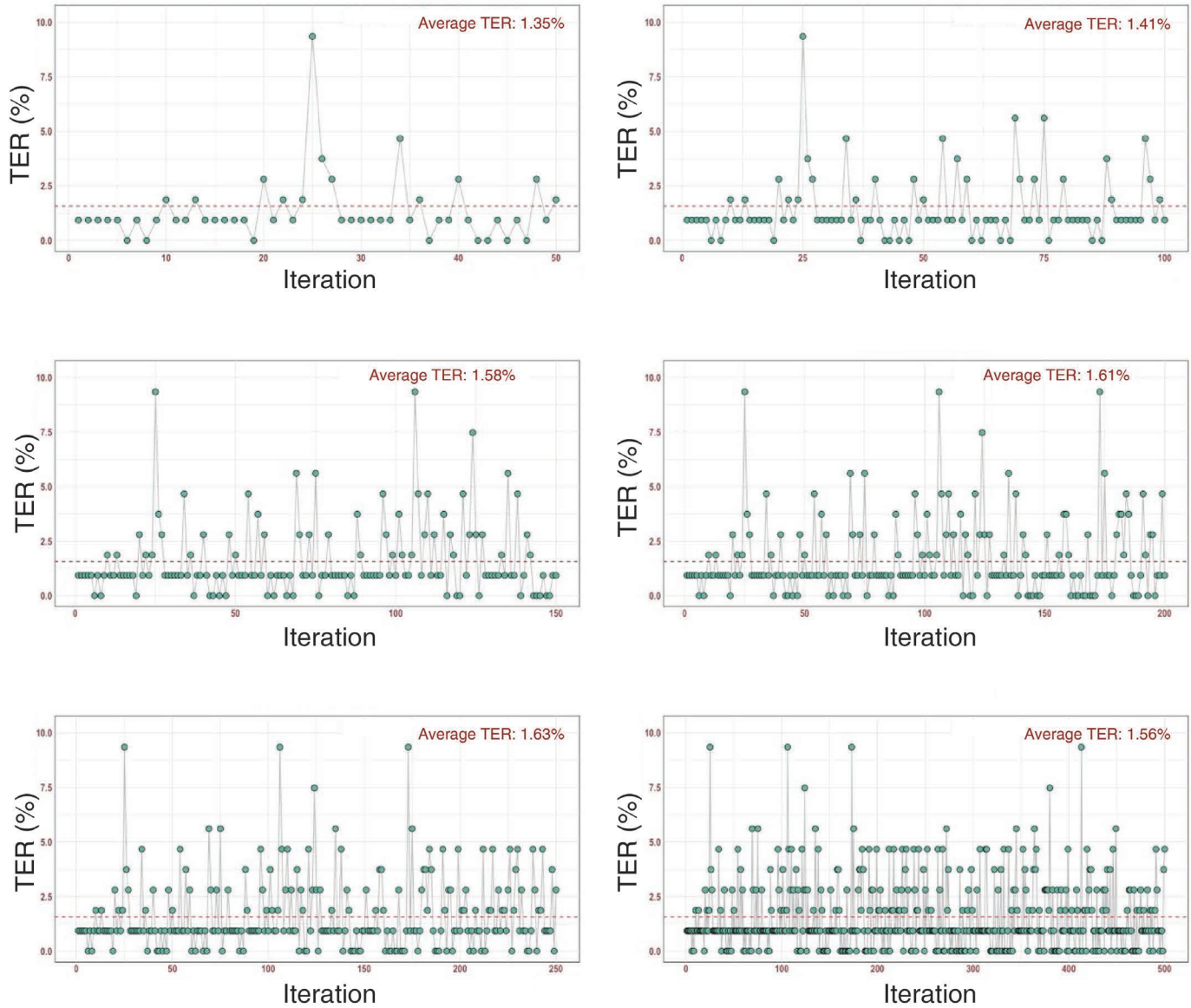
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Supplemental Figure 6 Hierarchical clustering analysis (HCA) optimization with clustering performance metrics. Three different indexes were assessed in response to varying number of clusters from 1 to 10: **A**) within sum of squares (WSS); **B**) silhouette width; **C**) gap statistic.

Supplemental Data for:

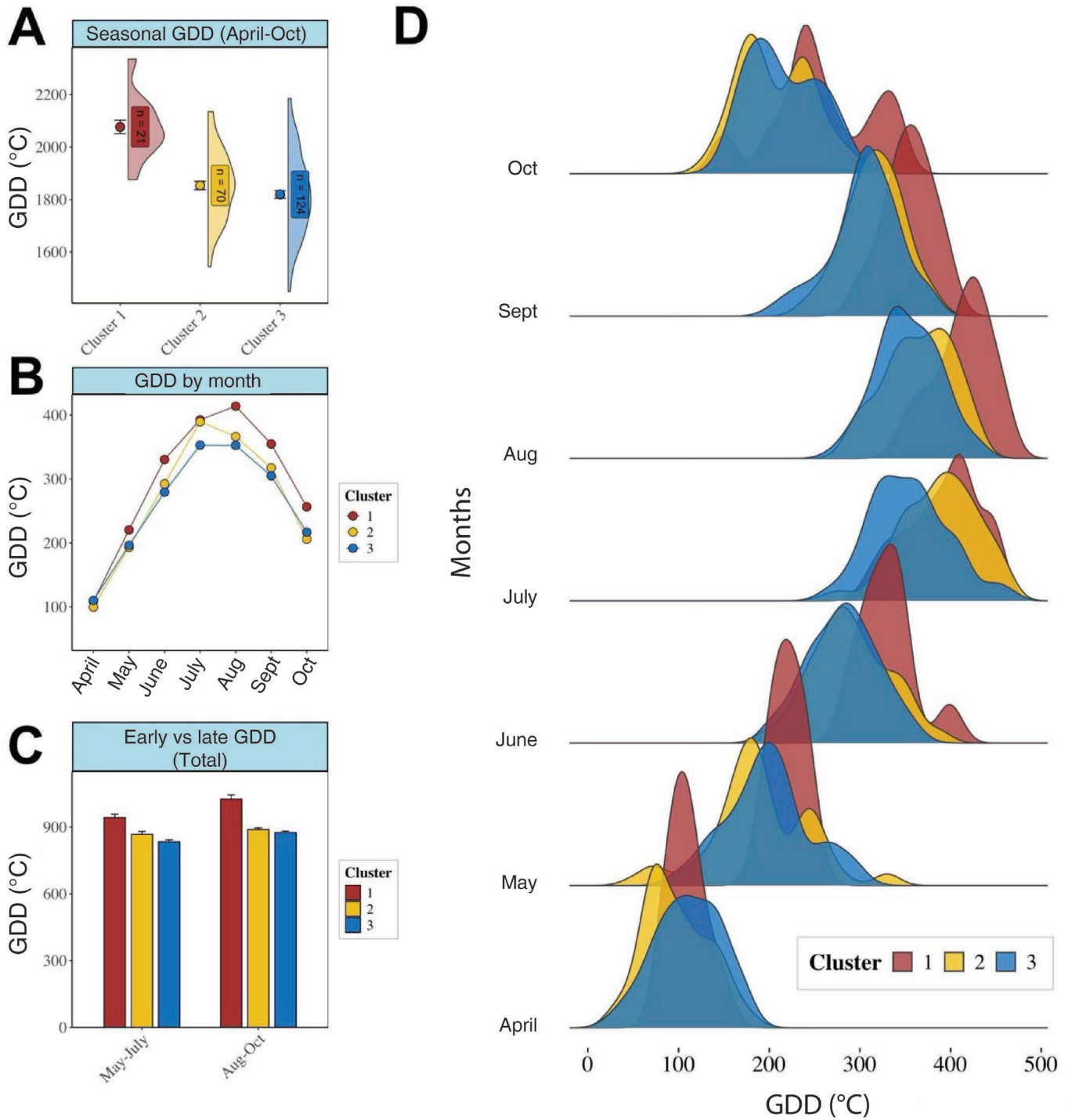
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Supplemental Figure 7 Cluster validation using iterative bootstrap random forest classification with three clusters. Each panel represents the test error rate (TER) for a given number of iterations, from 50 to 500. Green points represent TER values for each iteration. The red dashed line represents the average TER across all iterations, with the value annotated in red at the top of each graph.

Supplemental Data for:

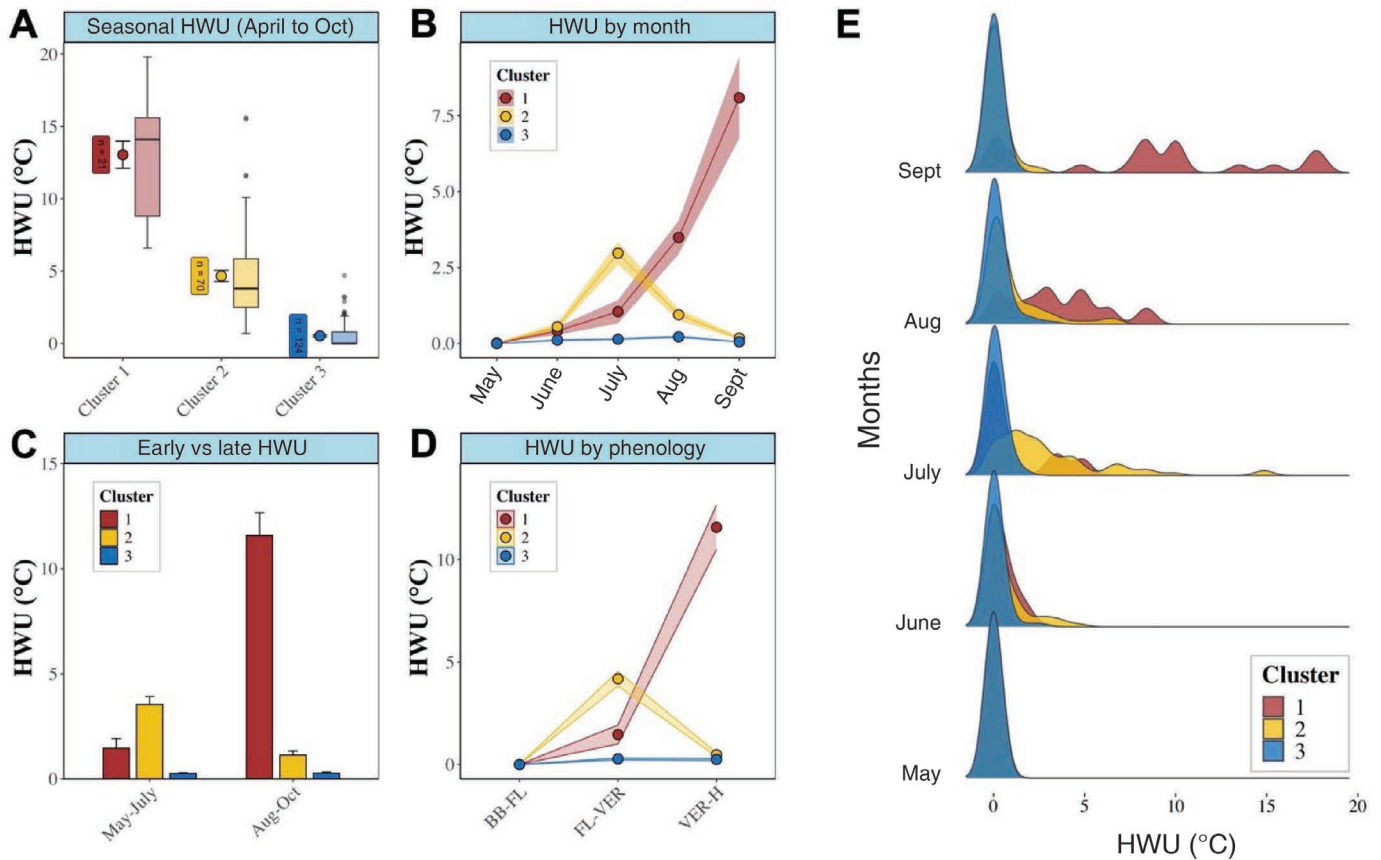
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Supplemental Figure 8 Growing degree day (GDD) features summarized by weather cluster. **A**) Distribution of total GDD (April to October) by cluster; **B**) monthly distribution of GDD averages by cluster; **C**) GDD by cluster early and late in the growing season; and **D**) monthly distribution of GDD values by cluster. Colors differentiate between clusters, indicating seasons with different heat levels: Cluster 1, postveraison heat; Cluster 2, preveraison heat; Cluster 3, cool seasons. When present, points and error bars represent means \pm standard error by cluster.

Supplemental Data for:

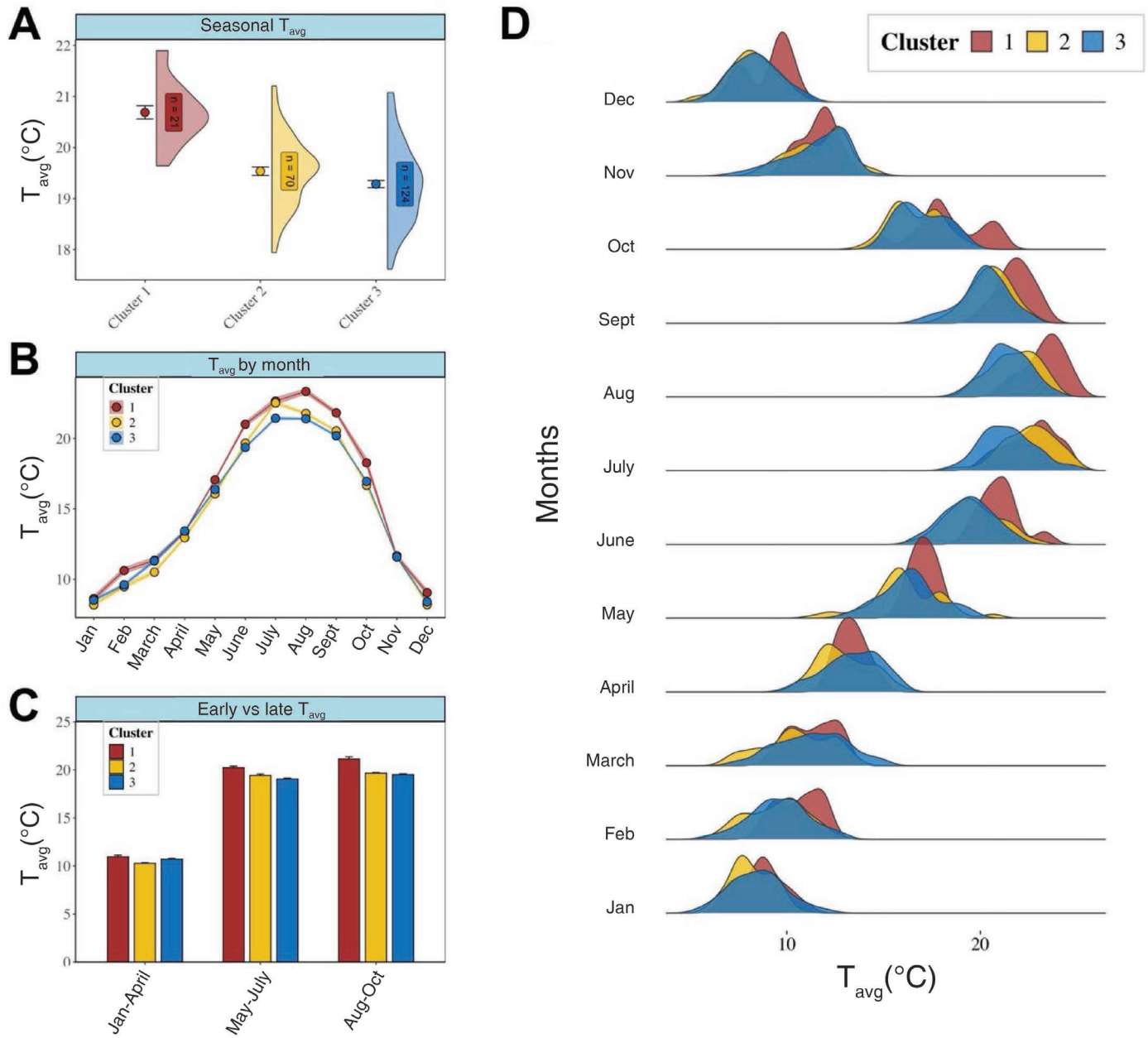
Previtali P, Giorgini F, Sanchez LA and Dokoozlian NK. 2026. Long-term weather observations reveal the impact of heatwaves on the yield and fruit composition of Cabernet Sauvignon. *Am J Enol Vitic* 77:0770001. DOI: 10.5344/ajev.2025.25017



Supplemental Figure 9 Heatwave unit (HWU) features summarized by weather cluster. HWU was calculated as the cumulative deviation of $T_{max} - 38^{\circ}\text{C}$, considering positive deviations only. **A**) Distribution of total HWU (April to October) by cluster; **B**) monthly distribution of HWU by cluster; **C**) HWU by cluster early (May to July) and late (August to October) in the growing season; **D**) summary of HWU by phenological stage (BB, budbreak; FL, flowering; VER, veraison; H, harvest); and **E**) monthly distribution of HWU values by cluster from May to October. Colors differentiate between clusters, indicating seasons with different heat levels: Cluster 1, postveraison; Cluster 2, preveraison heat; Cluster 3, cool seasons. When present, points and error bars represent means \pm standard error (SE) by cluster. Ribbons represent SE values in line charts.

Supplemental Data for:

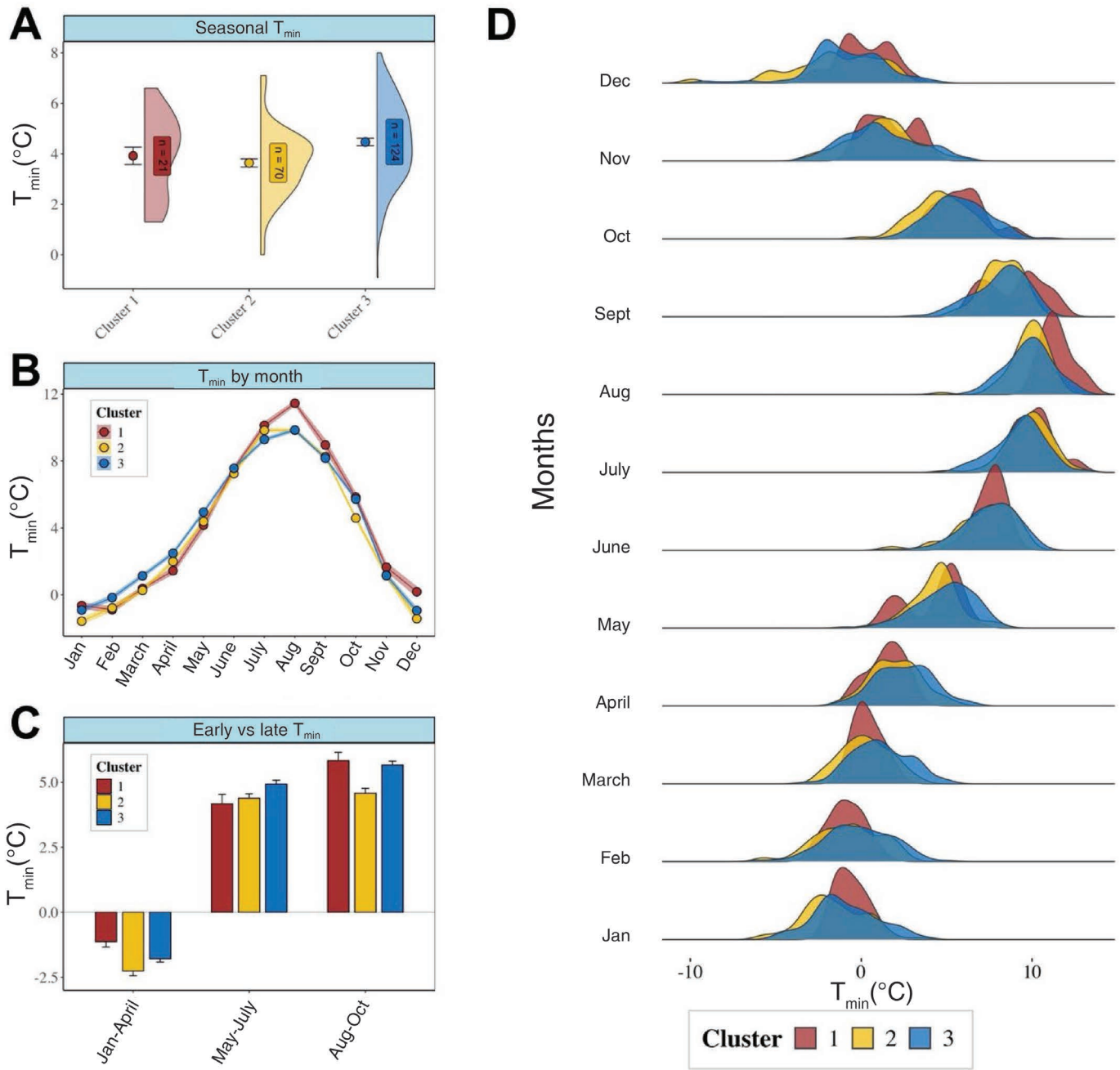
Previtali P, Giorgini F, Sanchez LA and Dokoozlian NK. 2026. Long-term weather observations reveal the impact of heatwaves on the yield and fruit composition of Cabernet Sauvignon. *Am J Enol Vitic* 77:0770001. DOI: 10.5344/ajev.2025.25017



Supplemental Figure 10 Average temperature (T_{avg}) features summarized by weather cluster. **A**) Distribution of seasonal T_{avg} values by cluster (April to October); **B**) monthly distribution of T_{avg} values by cluster; **C**) T_{avg} values by cluster early (May to July) and late (August to October) in the growing season; and **D**) monthly distribution of T_{avg} values by cluster. Colors differentiate between clusters, indicating seasons with different heat levels: Cluster 1, post-veraison heat; Cluster 2, preveraison heat; Cluster 3, cool seasons. When present, points and error bars represent means \pm standard error (SE) by cluster. Ribbons represent SE values in line charts.

Supplemental Data for:

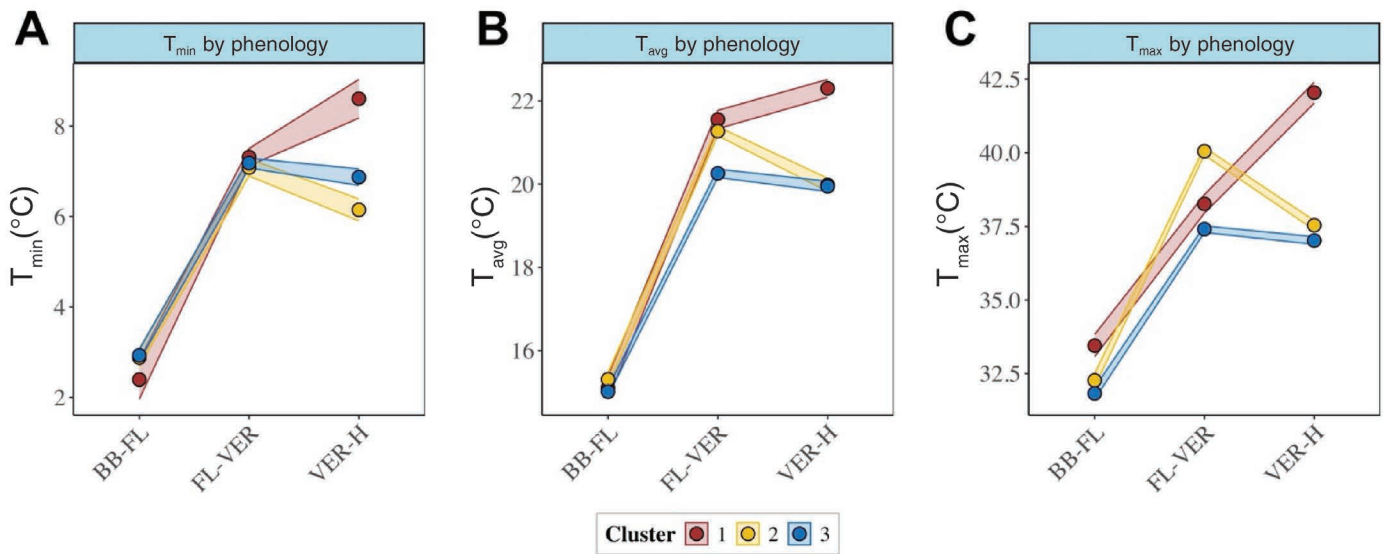
Previtali P, Giorgini F, Sanchez LA and Dokoozlian NK. 2026. Long-term weather observations reveal the impact of heatwaves on the yield and fruit composition of Cabernet Sauvignon. *Am J Enol Vitic* 77:0770001. DOI: 10.5344/ajev.2025.25017



Supplemental Figure 11 Minimum temperature (T_{min}) features summarized by weather cluster. **A**) Distribution of seasonal T_{min} values by cluster (April to Oct); **B**) monthly distribution of T_{min} values by cluster; **C**) T_{min} values by cluster before the growing season (January to April) and early (May to July) and late (August to October) in the growing season; and **D**) monthly distribution of T_{min} values by cluster. Colors differentiate between clusters, indicating seasons with different heat levels: Cluster 1, postveraison heat; Cluster 2, preveraison heat; Cluster 3, cool seasons. When present, points and error bars represent means \pm standard error (SE) by cluster. Ribbons represent SE values in line charts.

Supplemental Data for:

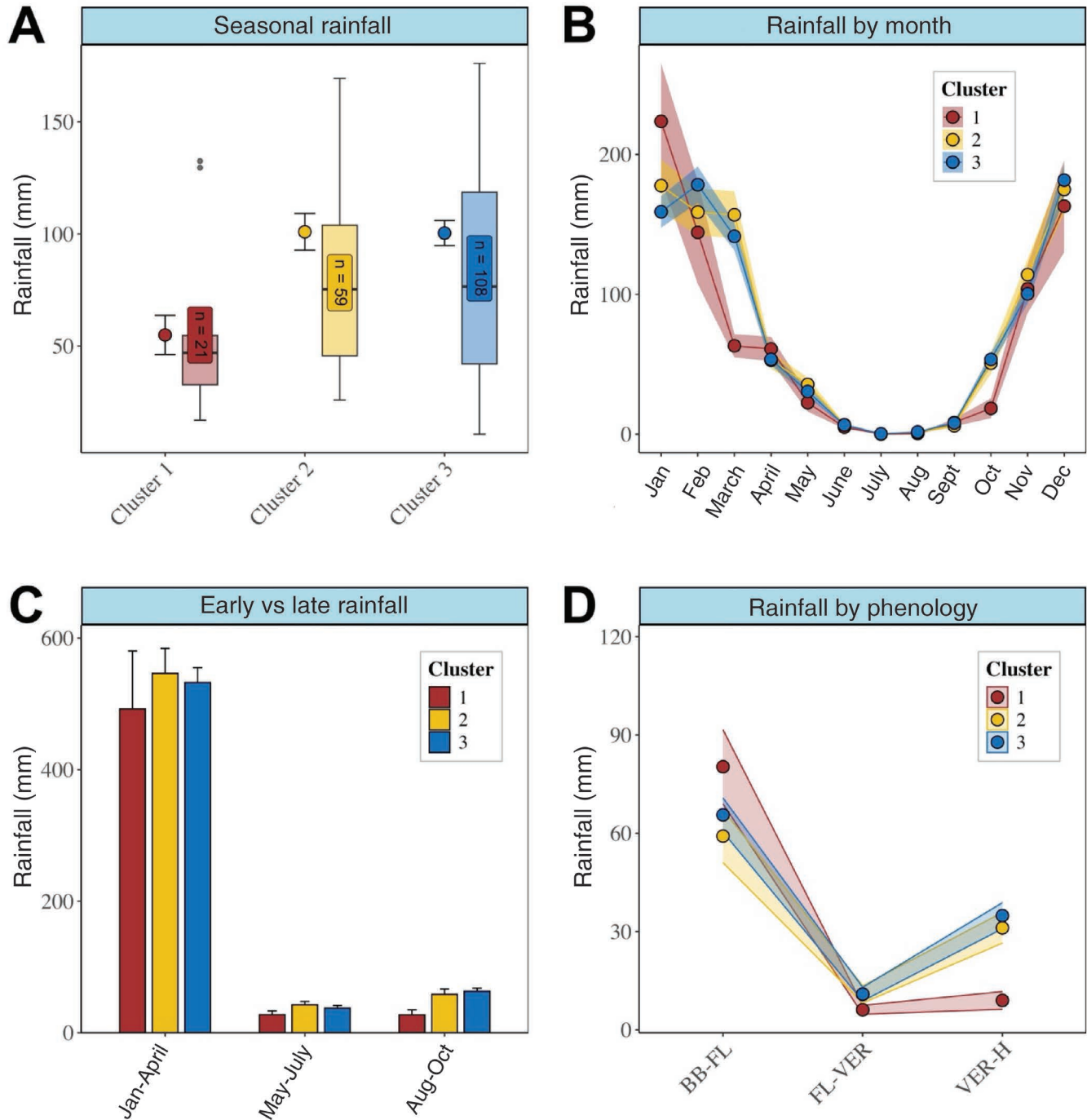
Previtali P, Giorgini F, Sanchez LA and Dokoozlian NK. 2026. Long-term weather observations reveal the impact of heatwaves on the yield and fruit composition of Cabernet Sauvignon. *Am J Enol Vitic* 77:0770001. DOI: 10.5344/ajev.2025.25017



Supplemental Figure 12 Changes in temperature by cluster according to phenological intervals (BB, budbreak; FL, flowering; VER, veraison; H, harvest). **A**) Minimum temperature (T_{\min}), **B**) average temperature (T_{avg}), and **C**) maximum temperature (T_{max}). Points and ribbons represent means \pm standard error. Colors differentiate between clusters, indicating seasons with different heat levels: Cluster 1, postveraison heat; Cluster 2, preveraison heat; Cluster 3, cool seasons.

Supplemental Data for:

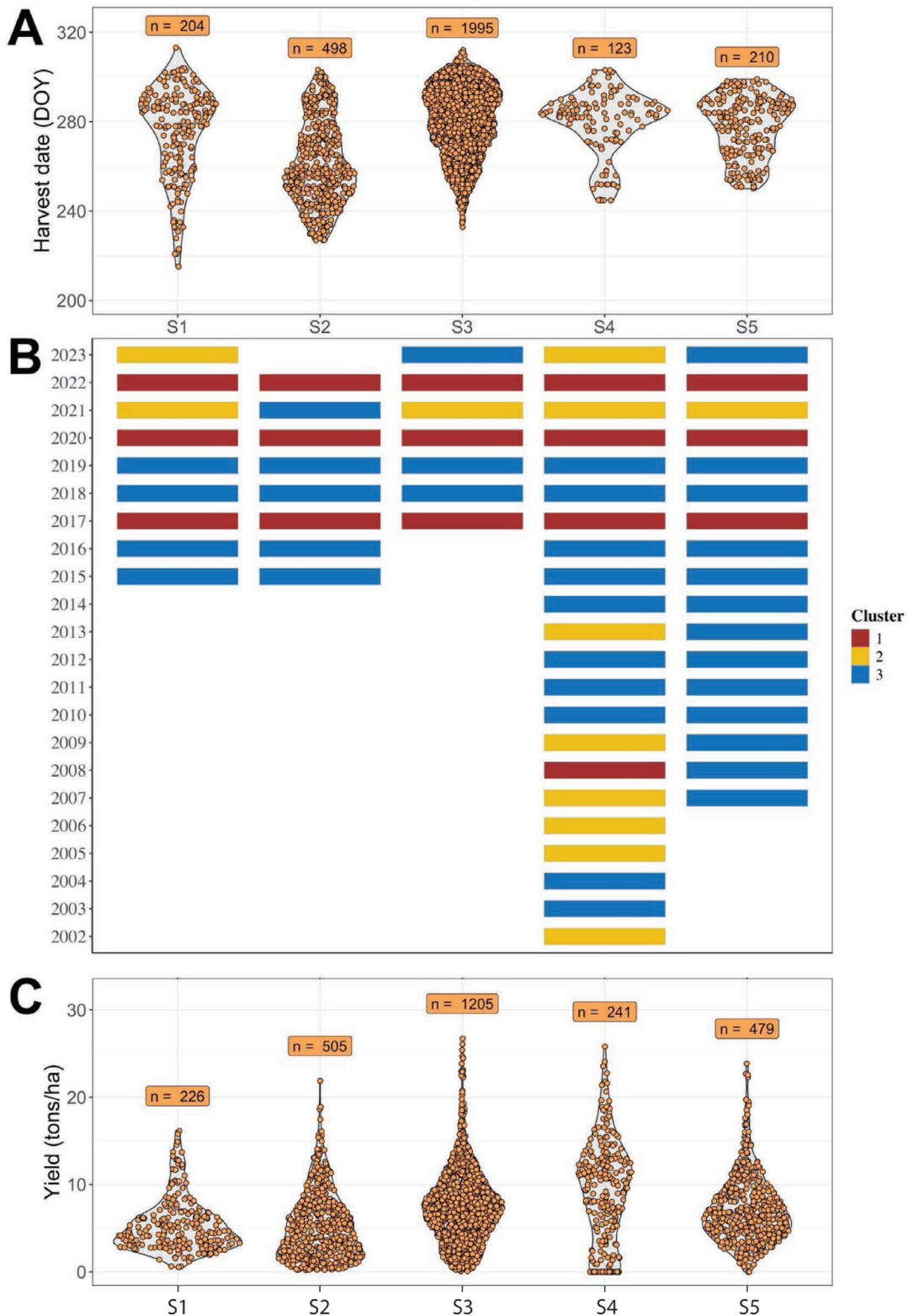
Previtali P, Giorgini F, Sanchez LA and Dokoozlian NK. 2026. Long-term weather observations reveal the impact of heatwaves on the yield and fruit composition of Cabernet Sauvignon. *Am J Enol Vitic* 77:0770001. DOI: 10.5344/ajev.2025.25017



Supplemental Figure 13 Rainfall features summarized by weather cluster. **A**) Distribution of seasonal rainfall by cluster (April to October); **B**) monthly distribution of rainfall by cluster; **C**) rainfall by cluster before the growing season (January to April) and early (May to July) and late (August to October) in the growing season; and **D**) rainfall by cluster according to phenological intervals (BB, budbreak; FL, flowering; VER, veraison; H, harvest). Colors differentiate between clusters, indicating seasons with different heat levels: Cluster 1, postveraison heat; Cluster 2, preveraison heat; Cluster 3, cool seasons. When present, points and error bars represent means \pm standard error (SE) by cluster. Ribbons represent SE values in line charts.

Supplemental Data for:

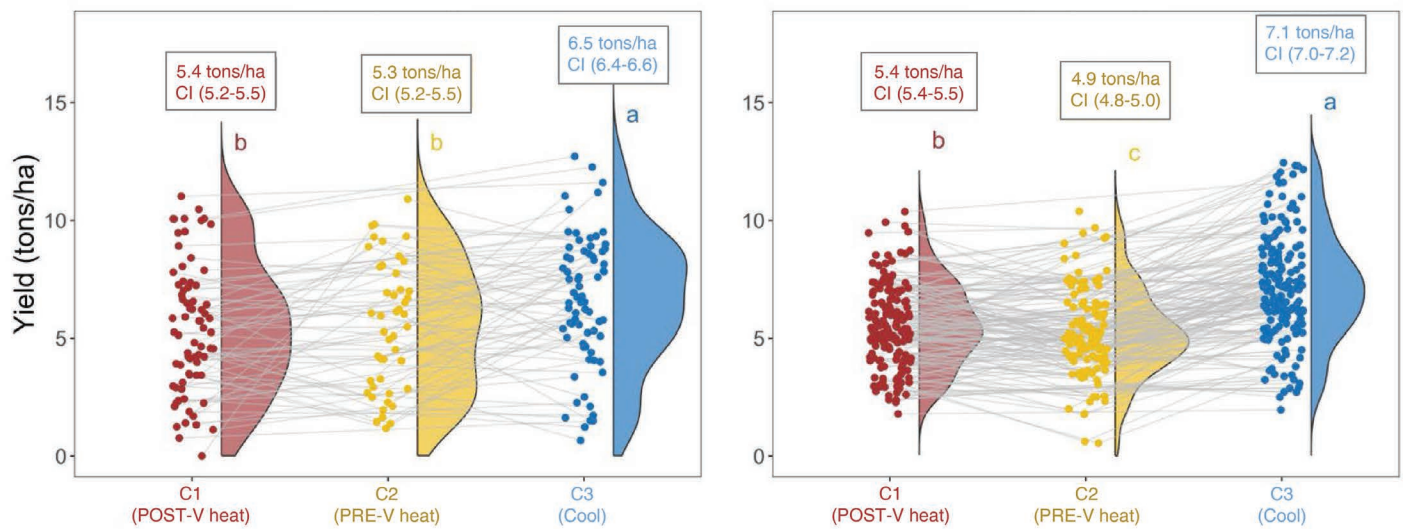
Previtali P, Giorgini F, Sanchez LA and Dokoozlian NK. 2026. Long-term weather observations reveal the impact of heatwaves on the yield and fruit composition of Cabernet Sauvignon. *Am J Enol Vitic* 77:0770001. DOI: 10.5344/ajev.2025.25017



Supplemental Figure 14 Exploratory analysis of harvest date (**A**) and yield (**C**) and cluster classification of seasons at the five sites (S1 to S5). In **A** and **C**, points represent data available at each site, with the number of observations by site annotated above the data distributions. In **B**, colors differentiate between clusters, indicating seasons with different heat levels: Cluster 1, postveraison heat; Cluster 2, preveraison heat; Cluster 3, cool seasons. DOY, day of year.

Supplemental Data for:

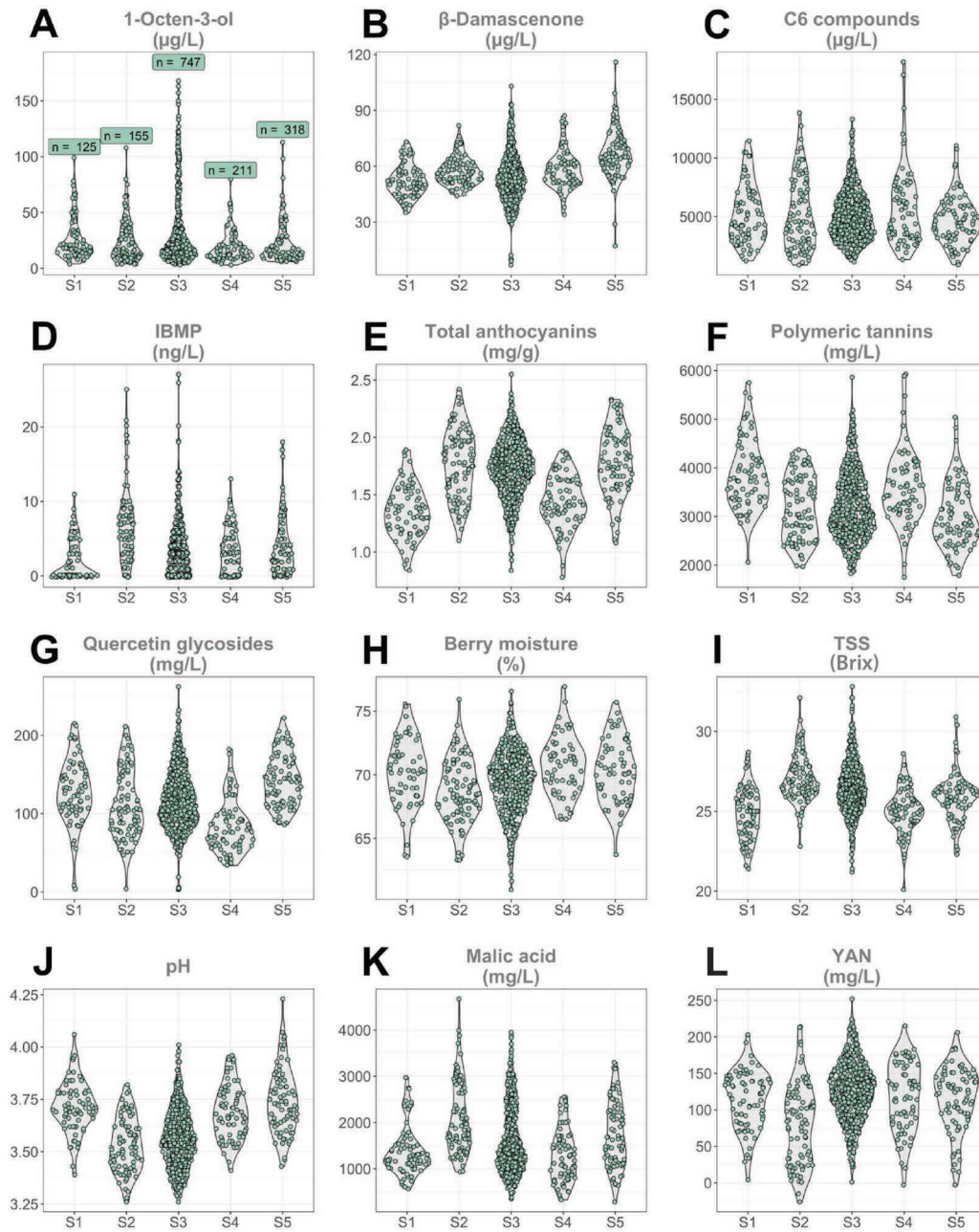
Previtali P, Giorgini F, Sanchez LA and Dokoozlian NK. 2026. Long-term weather observations reveal the impact of heatwaves on the yield and fruit composition of Cabernet Sauvignon. *Am J Enol Vitic* 77:0770001. DOI: 10.5344/ajev.2025.25017



Supplemental Figure 15 Effect of weather clusters on Cabernet Sauvignon yield, according to vineyard age. The same analysis was repeated after classifying vineyard blocks as young (3 to 5 yr, left graph) or mature (>5 yr, right graph). Points represent average yield for individual blocks summarized by cluster. Colors differentiate between clusters: Cluster 1 (C1; POST-V, postveraison heat), Cluster 2 (C2; PRE-V, preveraison heat), and Cluster 3 (C3; Cool, cool season). Gray lines connect averages for the same vineyard block belonging to different clusters. Density plots represent distributions by cluster for each age group. Labels report cluster means and 95% confidence intervals (CI) by group, calculated using a linear mixed model where clusters were the fixed effect and vineyard blocks were the random effect on the model intercept. Different letters denote statistical differences between clusters for each age group according to Tukey's adjusted multiple comparison post-hoc test with $\alpha \leq 0.05$.

Supplemental Data for:

Previtali P, Giorgini F, Sanchez LA and Dokoozlian NK. 2026. Long-term weather observations reveal the impact of heatwaves on the yield and fruit composition of Cabernet Sauvignon. *Am J Enol Vitic* 77:0770001. DOI: 10.5344/ajev.2025.25017



Supplemental Figure 16 Exploratory analysis of grape analytes measured at five different sites. **A to L** represent single fruit composition parameters and points represent data available for each site (S1 to S5). The number of observations by site is annotated on top of data distributions in the first plot only. IBMP, 3-isobutyl-2-methoxypyrazine; TSS, total soluble solids; YAN, yeast assimilable nitrogen.