Table S1 Primers used for qRT-PCR analysis of *VvCBF* genes

Gene Name	Primer Type	Primer Sequence (5’→3’)	Product Length (bp)	Tm Value (℃)
VvCBF1	Forward (F)	TGGAGGTCTCAACATTCTTC	120	54.69
	Reverse (R)	GACTGTTCACGCTTCATCT		55.27
VvCBF2	Forward (F)	CATCATCCTGCTCCATACA	200	53.99
	Reverse (R)	ACATTCCAACCACCATCAT		54.27
VvCBF3	Forward (F)	AGGCAGCGAAGAGTTGAT	400	56.22
	Reverse (R)	CCATATTCACCAGCAGACC		55.35
VvActin	Forward (F)	CTTGCATCCCTCAGCACCTT	80	60.32
	Reverse (R)	TCCTGGACAATGGATGGA		54.61

Table S2 F_v/F_m and chlorophyll parameters of own-rooted vines (mean±SD)

Parameter	Treatment	CS	CH	5BB	Beta	3309C
F_v/F_m	CK	0.72±0.01a	0.72±0.00a	0.72±0.02a	0.72±0.01a	0.72±0.01a
	Frost	0.50±0.05d	0.38±0.02e	0.64±0.02b	0.67±0.04b	0.56±0.05c
Chlorophylla (mg/g)	CK	1.28±0.02ab	1.32±0.02a	1.21±0.03abc	1.26±0.10ab	1.27±0.05ab
	Frost	0.81±0.01e	0.66±0.04e	1.12± 0.10bcd	1.06±0.21cd	0.97±0.05d
Chlorophyllb (mg/g)	CK	0.58±0.02a	0.61±0.03a	0.59±0.02a	0.61±0.05a	0.61±0.03a
	Frost	0.33±0.01b	0.26±0.02b	0.57±0.08a	0.49±0.20a	0.50±0.04a
Chlorophyll（a/b）	CK	2.22±0.05a	2.15± 0.11ab	2.05±0.01c	2.08±0.04bc	2.08±0.03c
	Frost	2.41± 0.003ab	2.51±0.04a	2.00±0.37cd	2.32±0.49bc	1.95±0.06d

Table S3 F_v/F_m and chlorophyll parameters of own-rooted and grafted vines (mean±SD)

Parameter	Treatment	CH	CH/Beta	CH/5BB	CH/3309	CS	CS/Beta	CS/5BB	CS/3309
F_v/F_m	CK	0.72± 0.00ab	0.73± 0.01a	0.76± 0.01a	0.67± 0.04a	0.72± 0.01ab	0.74± 0.01a	0.74± 0.02a	0.73± 0.01a
	Frost	0.38± 0.02e	0.61± 0.09cdc	0.74± 0.01bc	0.63± 0.04bdc	0.50± 0.05d	0.63± 0.03bdc	0.65± 0.05bdc	0.55± 0.01d
Chlorophyll	CK	1.32±	1.11±	1.47±	1.03±	1.28±	1.29±	1.32±	1.16±

Parameter	Treatment	CH	CH/Beta	CH/5BB	CH/3309	CS	CS/Beta	CS/5BB	CS/3309
a (mg/g)		0.02ab	0.13bcde	0.38a	0.01de	0.02abc	0.03ab	0.01ab	0.03bcd
Chlorophyll b (mg/g)	Frost	0.66±0.04g	1.19±0.20bcd	1.11±0.07bcde	1.00±0.05def	0.81±0.01fg	1.05±0.02cde	1.05±0.12cde	0.92±0.12ef
	CK	0.61±0.03abc	0.69±0.24ab	0.77±0.25a	0.54±0.01bcd	0.58±0.02abc	0.63±0.04abc	0.58±0.01abc	0.79±0.22a
	Frost	0.26±0.02e	0.51±0.04bcd	0.51±0.04bcd	0.52±0.04bcd	0.33±0.01de	0.44±0.03cde	0.46±0.06cde	0.34±0.05de
Chlorophyll（a/b）	CK	2.15±0.13ab	1.69±0.37c	1.97±0.24bc	1.92±0.02bc	2.22±0.05ab	2.05±0.16abc	2.29±0.02a	1.56±0.43c
	Frost	2.51±0.04b	2.36±0.48bb	2.22±0.29b	1.92±0.08c	2.41±0.003b	2.38±0.12b	2.31±0.19b	2.78±0.31a

Table S4 Two-way ANOVA results (scion × rootstock)

Parameter	Scion (S) F-value (P)	Rootstock (R) F-value (P)	Scion×Rootstock (S×R) F-value (P)
F_v/F_m	12.67 (<0.001)	38.92 (<0.001)	7.24 (<0.01)
Chlorophyll a	4.32 (<0.05)	19.56 (<0.001)	5.18 (<0.05)
Chlorophyll b	3.89 (<0.05)	22.11 (<0.001)	6.03 (<0.01)
Chlorophyll a/b	1.26 (0.274)	4.89 (<0.01)	2.97 (<0.05)

Table S5 REL and MDA content of own-rooted vines (mean±SD)

Parameter	Treatment	CS	CH	5BB	Beta	3309C
Leaf REL(%)	CK	30.91±2.28e	21.66±0.51f	30.36±2.78e	24.48±2.02f	38.22±5.14cd
	Frost	45.08±4.17b	55.33±5.06a	41.66±2.47bc	34.64±3.59de	51.27±2.71a
Root REL(%)	CK	32.06±5.41cd	34.16±3.77cd	23.65±3.81d	20.98±1.73d	39.31±8.41bc
	Frost	76.16±8.83a	76.82±7.26a	72.44±10.26a	52.29±14.08b	71.36±8.29a
Leaf MDA (μmol/g FW)	CK	26.51±0.73b	19.17±0.34cd	16.37±2.33d	19.71±3.12c	17.52±1.62cd
	Frost	33.53±0.52a	33.42±0.28a	26.71±2.27b	32.37±1.95a	34.07±0.92a
Root MDA (μmol/g FW)	CK	17.03±1.96d	17.64±2.26d	12.59±0.63ef	11.63±0.22f	14.01±0.85e
	Frost	29.95±0.67a	27.90±0.54b	17.57±1.25d	21.19±0.54c	22.45±0.45c

Table S6 REL and MDA content of own-rooted and grafted vines (mean±SD)

Parameter	Treatment	CH	CH/Beta	CH/5BB	CH/3309	CS	CS/Beta	CS/5BB	CS/3309
Leaf REL(%)	CK	21.66±0.51i	23.18±1.74hi	23.43±1.65ghi	24.70±5.76ghi	30.91±2.28efg	26.69±4.73fghi	25.48±4.00fghi	28.39±5.31efgh
	Frost	55.33±5.06a	38.80±2.00cd	31.42±2.57ef	34.57±2.37de	45.08±4.17b	38.21±1.34cd	34.76±1.24de	42.20±2.76ab
Root REL(%)	CK	34.16±3.77e	11.82±0.19f	24.33±0.20f	22.59±0.34f	32.06±5.41ef	19.85±0.86f	19.17±0.34f	22.59±0.34ef
	Frost	76.82±	29.53±	30.31±	31.74±	76.16±	32.30±	32.33±	32.33±

Parameter	Treatment	CH	CH/Beta	CH/5BB	CH/3309	CS	CS/Beta	CS/5BB	CS/3309
Leaf MDA (μmol/g FW)	CK	7.26ab 19.17± 0.34g	0.92b 23.81± 2.73c	2.75cd 22.70± 1.42e	0.50cd 23.01± 1.55f	8.83a 26.51± 0.73d	0.60cd 24.61± 3.08g	0.25d 22.94± 1.25g	0.77c 29.56± 1.70f
	Frost	33.42± 0.28ab	63.17± 5.22c	45.87± 2.30c	50.15± 8.05b	33.53± 0.52a	47.61± 4.29ab	43.86± 6.13ab	53.68± 8.11ab
Root MDA (μmol/g FW)	CK	17.64± 2.26cd	11.04± 0.66gh	10.25± 0.44hi	12.99± 0.71fg	17.03± 1.96cde	12.08± 0.60gh	8.62± 1.77i	14.62± 0.18ef
	Frost	27.90± 0.54a	15.22± 0.52def	15.15± 0.60ef	16.46± 1.75cde	29.95± 0.67a	18.67± 1.55bc	12.43± 1.62gh	20.61± 2.18b

Table S7 Two-way ANOVA results (scion × rootstock)

Parameter	Scion (S)	Rootstock (R)	Scion×Rootstock(S×R)
	F-value (P)	F-value (P)	F-value (P)
Leaf REL	18.25 (<0.001)	32.67 (<0.001)	8.42 (<0.01)
Root REL	5.12 (<0.05)	41.39 (<0.001)	10.76 (<0.001)
Leaf MDA	22.71 (<0.001)	15.83 (<0.001)	6.95 (<0.01)
Root MDA	9.37 (<0.01)	56.24 (<0.001)	12.18 (<0.001)

Table S8 Soluble sugar and proline content of own-rooted vines (mean±SD)

Parameter	Treatment	CS	CH	5BB	Beta	3309C
Leaf soluble sugar(μg/g FW)	CK	18.99± 1.94d	18.78± 0.79d	21.74± 2.10bcd	19.85± 1.06cd	21.90± 1.92bcd
	Frost	27.49± 6.11ab	27.14± 0.75ab	26.73± 5.13ab	25.34± 2.55abc	29.13± 4.56a
Root soluble sugar(μg/g FW)	CK	10.83± 1.35d	12.43± 1.01c	9.65± 0.50de	8.92± 0.16e	10.35± 0.58de
	Frost	21.69± 1.04a	17.33± 1.41b	13.47± 0.96c	16.24± 0.41b	17.21± 0.34b
Leaf proline(μg/g FW)	CK	5.32± 0.49e	11.06± 0.22b	10.78± 0.06b	5.98± 0.09e	5.51± 0.04e
	Frost	7.72± 1.60d	28.65± 0.39a	10.71± 0.13b	7.54± 0.72d	9.32± 0.90c
Root proline (μg/g FW)	CK	4.49± 0.22d	5.79± 0.53c	2.59± 0.21g	3.17± 0.02fg	3.65± 0.06ef
	Frost	7.59± 0.64b	10.57± 1.04a	4.41± 0.18de	4.53± 0.15d	5.39± 0.28c

Table S9 Soluble sugar and proline content of own-rooted and grafted vines (mean±SD)

Parameter	Treatment	CH	CH/Beta	CH/5BB	CH/3309	CS	CS/Beta	CS/5BB	CS/3309
Leaf soluble sugar(μg/g FW)	CK	18.78± 0.79ef	21.10 ± 1.11def	20.46 ± 0.77def	21.89 ± 1.46cdef	18.99± 1.94ef	20.62± 1.00def	18.48± 0.34f	20.73 ± 0.45def
	Frost	27.14± 0.75a	23.21 ± 0.70abcde	22.54 ± 0.72bcdef	25.84 ± 1.46abc	27.49± 6.11a	26.41± 4.41ab	21.03± 1.10def	24.66 ± 3.17abcd
Root soluble sugar(μg/g	CK	12.43± 1.01cd	11.82 ± 0.19c	7.32± 0.08cd	4.39± 0.02c	10.83± 1.35de	6.44± 0.01de	6.85± 0.20e	5.84± 0.06e

Parameter	Treatment	CH	CH/Beta	CH/5BB	CH/3309	CS	CS/Beta	CS/5BB	CS/3309
FW)	Frost	17.33±1.41b	17.92±0.59b	12.84±0.03b	11.35±0.20a	21.69±1.04a	7.36±0.08b	9.38±0.13b	7.53±0.15b
Leaf proline(μg/g FW)	CK	11.06±0.22d	13.73±0.50d	11.90±1.56f	13.87±1.76ij	5.32±0.49i	10.70±1.26gh	9.52±1.13fg	9.77±0.53hi
	Frost	28.65±0.39a	18.37±0.68b	18.60±1.55c	21.07±0.55d	7.72±1.60f	17.83±0.65f	18.23±0.82e	17.76±1.12f
Rootproline (μg/gFW)	CK	5.79±0.53e	4.47±0.62f	5.99±0.68de	4.09±0.27f	4.49±0.22f	5.29±0.36ef	5.86±0.52de	5.28±1.04ef
	Frost	10.57±1.04a	7.37±0.97c	8.07±0.89c	8.13±0.13c	7.59±0.64c	7.03±0.51cd	9.43±0.79b	7.04±0.63cd

Table S10 Two-way ANOVA results (scion × rootstock)

Parameter	Scion (S)	Rootstock (R)	Scion×Rootstock (S×R)
	F-value (P)	F-value (P)	F-value (P)
Leaf soluble sugar	6.82 (<0.01)	21.54 (<0.001)	7.31 (<0.01)
Root soluble sugar	10.27 (<0.01)	35.68 (<0.001)	9.85 (<0.001)
Leaf proline	42.19 (<0.001)	57.32 (<0.001)	12.67 (<0.001)
Root proline	4.75 (<0.05)	28.41 (<0.001)	8.13 (<0.01)

Table S11 H_2O_2 content and enzyme activity of own-rooted vines (mean±SD)

Parameter	Treatment	CS	CH	5BB	Beta	3309C
Leaf H_2O_2 (μmol/g FW)	CK	1.60±0.23c	1.70±0.08c	0.57±0.02e	0.46±0.03e	0.50±0.01e
	Frost	3.32±0.11b	3.88±0.16a	1.53±0.21c	1.09±0.02d	1.59±0.02c
Leaf POD (U/min •g FW)	CK	424.45±53.28de	651.83±97.87abc	447.50±26.29cde	320.00±91.65e	671.11±23.09ab
	Frost	764.44±252.60ab	728.89±65.06ab	582.50±90.00bcd	566.67±140.00bcd	811.11±73.33a
Leaf SOD (U/min •g FW)	CK	1618.64±8.13a	1569.88±11.45bcd	1359.60±6.00f	1475.69±30.74e	1543.36±46.72cd
	Frost	1584.15±5.50abc	1550.32±5.00cd	1537.05±30.85d	1607.69±5.50ab	1611.99±7.50ab
Leaf CAT (U/min •g FW)	CK	10.69±1.71b	7.63±1.21cd	6.86±0.24d	7.16±0.12d	7.49±0.19cd
	Frost	14.03±2.92a	8.67±1.37bcd	10.06±0.61b	10.17±0.20b	9.67±0.31bc
Leaf APX (U/min •g FW)	CK	323.67±60.29b	504.95±71.29b	371.61±27.45b	318.83±22.45b	423.31±21.70b
	Frost	1916.67±500.00a	1731.09±906.15a	863.19±31.68b	912.33±33.10b	961.46±41.50b

Table S12 H_2O_2 content and enzyme activity of own-rooted and grafted vines (mean±SD)

Parameter	Treatment	CH	CH/Beta	CH/5BB	CH/3309	CS	CS/Beta	CS/5BB	CS/3309
Leaf H_2O_2 (μmol/g	CK	1.70±0.08ghi	1.48±0.28hi	1.28±0.19i	1.74±0.03gh	1.60±0.23ghi	1.78±0.18gh	1.79±0.38gh	1.90±0.42fgh

Parameter	Treatment	CH	CH/Beta	CH/5BB	CH/3309	CS	CS/Beta	CS/5BB	CS/3309
Leaf POD (U/min • g FW)	Frost	3.88±0.16a	2.47±0.32de	2.37±0.11de	2.92±0.06bc	3.32±0.11b	2.27±0.30def	2.05±0.26efg	2.69±0.33cd
	CK	651.83±97.87fgh	780.00±231.00defg	720.00±200.00efg	490.00±76.48gh	424.45±53.28h	853.33±231.86cdef	533.33±86.58gh	834.67±128.00cdef
	Frost	728.89±65.06defg	985.56±25.00bcde	1086.67±146.00bc	720.00±40.00efg	764.44±252.60defg	1396.67±70.00a	1146.67±160.00ab	1025.33±238.00bcd
Leaf SOD (U/min • g FW)	CK	1569.88±11.45b	1504.74±60.00c	1555.25±8.50b	1575.19±6.00b	1618.64±8.13a	1424.94±56.00d	1466.73±22.50c	1564.58±9.50b
	Frost	1550.32±5.00b	1576.18±3.00b	1579.16±8.00ab	1583.16±2.50ab	1584.15±5.50ab	1584.15±5.50ab	1575.48±8.00b	1576.18±3.00b
Leaf CAT (U/min • g FW)	CK	7.63±1.21bcd	6.88±1.36cd	7.41±0.64cd	7.32±0.26cd	10.69±1.71b	8.19±0.88bcd	6.64±0.62d	9.96±1.02bc
	Frost	8.67±1.37bcd	7.45±1.05bcd	10.72±2.16b	14.85±3.27a	14.03±2.92a	15.09±0.56a	15.04±2.12a	9.87±1.20bcd
Leaf APX (U/min • g FW)	CK	504.95±71.29ef	778.89±71.00def	619.99±200.00ef	423.81±80.00ef	323.67±60.29ef	223.81±40.00f	337.14±71.00ef	369.05±50.00ef
	Frost	1731.09±906.15c	3423.81±720.00ab	3060.00±550.00b	2000.00±150.00c	1916.67±500.00c	1590.00±580.00cd	4190.48±270.00a	1152.38±600.00cde

Table S13 Two-way ANOVA results (scion × rootstock)

Parameter	Scion (S)	Rootstock (R)	Scion×Rootstock (S×R)
	F-value (P)	F-value (P)	F-value (P)
Leaf H_2O_2	12.75 (<0.001)	28.32 (<0.001)	7.91 (<0.01)
Leaf POD	9.26 (<0.01)	15.68 (<0.001)	6.43 (<0.01)
Leaf SOD	4.82 (<0.05)	21.45 (<0.001)	8.77 (<0.001)
Leaf CAT	11.39 (<0.001)	18.27 (<0.001)	5.92 (<0.01)
Leaf APX	15.18 (<0.001)	32.74 (<0.001)	9.43 (<0.001)

Table S14 Spring frost resistance affiliation function values for different grafted vines of 'Cabernet Sauvignon'

	CS	CS/Beta	CS/5BB	CS/3309
Leaf REL	0.000	0.542	1.000	0.077
F_v/F_m	0.000	0.892	1.000	0.351
chlorophyll	0.000	1.000	0.857	0.076
Leaf soluble sugar	1.000	0.546	0.000	0.232
Leaf soluble protein	1.000	0.910	0.000	0.467
Leaf proline	1.000	0.000	0.941	0.453

Leaf H_2O_2	0.000	0.849	1.000	0.634
Superoxide anion	0.000	0.880	0.742	1.000
Leaf MDA	0.000	0.719	0.648	1.000
Leaf CAT	0.069	0.000	0.393	1.000
Leaf POD	0.353	0.834	1.000	0.000
Leaf SOD	0.000	1.000	0.740	0.241
Leaf APX	0.264	0.190	1.000	0.000
Root REL	0.000	0.961	1.000	0.861
Root proline	0.745	0.000	1.000	0.015
Root soluble sugar	1.000	0.000	0.423	0.229
Root MDA	0.000	0.622	1.000	0.681
Root H_2O_2	0.000	0.873	1.000	0.253
VvCBF1	0.000	0.658	1.000	0.462
VvCBF2	1.000	0.792	0.458	0.000
VvCBF3	0.000	1.000	0.464	0.468
D-Vaule	0.306	0.632	0.746	0.405
Rank	4	2	1	3

Table S15 Spring frost resistance affiliation function values for different grafted vines of ‘Chardonnay’

	CH	**CH/Beta**	**CH/5BB**	**CH/3309**
Leaf REL	0.000	0.703	1.000	0.927
F_v/F_m	0.000	0.892	1.000	0.932
chlorophyll	0.000	0.411	0.952	1.000
Leaf soluble sugar	0.000	0.996	1.000	0.702
Leaf soluble protein	1.000	0.000	0.670	0.026
Leaf proline	0.000	0.662	0.435	1.000
Leaf H_2O_2	0.000	1.000	0.915	0.842
Superoxide anion	0.000	0.932	1.000	0.909
Leaf MDA	0.000	1.000	0.841	0.710
Leaf CAT	0.408	0.747	1.000	0.000
Leaf POD	0.000	0.444	1.000	0.528
Leaf SOD	0.000	1.000	0.480	0.282
Leaf APX	0.000	1.000	0.855	0.224
Root REL	0.000	0.131	1.000	0.759
Root proline	1.000	0.306	0.000	0.726
Root soluble sugar	0.104	0.000	0.805	1.000
Root MDA	0.000	0.890	0.786	1.000
Root H_2O_2	0.000	1.000	0.781	0.610
VvCBF1	0.000	0.565	1.000	0.331
VvCBF2	0.000	0.547	1.000	0.710
VvCBF3	0.018	0.573	1.000	0.000
D-Vaule	0.120	0.657	0.834	0.629

Rank	4	3	1	2

Table S16 Estimated survial rate of own-rooted and grafted vines under frost stress.

Own-rooted vines	Survial rate	Grafted vines	Survial rate
CS	53.3%	**CS/5BB**	93.3%
CH	40.0%	**CS/Beta**	86.7%
5BB	86.7%	**CS/3309**	80.0%
Beta	93.3%	**CH/5BB**	86.7%
3309	73.3%	**CH/Beta**	73.3%
		CH/3309	73.3%