

Multi-locus genome-wide association studies reveal novel alleles for flowering time under vernalisation and extended photoperiod in a barley MAGIC population

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Table S1 List of trials conducted in Perth, Corrigin and Esperance, Western Australia with different sowing dates, vernalisation and extended photoperiod from 2017 to 2019

Trial	Sowing date	Location	Treatment
1	30 th May 2017	Perth	No
2	31 st May 2018	Corrigin	No
3	09 th May 2018	Esperance	No
4	24 th May 2018	Perth	No
5	18 th April 2019	Perth	No
6	15 th May 2019	Perth	No
7	18 th June 2019	Perth	No
8	18 th July 2019	Perth	No
9	06 th August 2019	Perth	No
10	15 th May 2019	Perth	18-hour photoperiod
11	18 th April 2019	Perth	6-week vernalisation
12	15 th May 2019	Perth	6-week vernalisation
13	18 th June 2019	Perth	6-week vernalisation
14	18 th July 2019	Perth	6-week vernalisation
15	06 th August 2019	Perth	4-week vernalisation

Table S2 Additional KASP markers for phenology and semi-dwarf genes

Chromosome	Position	Gene name
1H	26,220,293	
1H	411,257,151	<i>ZCCTc</i>
1H	458,874,152	<i>STK</i>
1H	490,940,854	<i>GA20ox2-2</i>
1H	490,941,064	<i>GA20ox2-2</i>
1H	497,763,802	<i>LCC</i>
1H	514,098,322	<i>FT3 (PPD-H2)</i>
1H	515,519,668	<i>GA2ox4</i>
1H	538,165,591	<i>GA2ox1</i>
1H	556,900,431	<i>ELF3</i>
1H	556,903,491	<i>ELF3</i>
1H	558,225,979	<i>CMF6b</i>
1H	558,226,159	<i>CMF6b</i>
2H	2,087,259	<i>EFS</i>
2H	2,087,380	<i>EFS</i>
2H	2,097,742	<i>EFS</i>
2H	6,177,044	<i>LIM3</i>
2H	6,177,615	<i>LIM3</i>
2H	29,123,942	<i>Ppd-H1</i>
2H	29,125,815	<i>Ppd-H1</i>
2H	40,288,295	<i>CDF1</i>
2H	68,835,904	<i>FT4</i>
2H	128,268,917	<i>GW7</i>
2H	128,269,079	<i>GW7</i>
2H	128,271,153	<i>GW7</i>

2H	201,118,546	<i>CBF8A</i>
2H	201,118,611	<i>CBF8A</i>
2H	432,062,326	<i>BM8</i>
2H	432,062,544	<i>BM8</i>
2H	611,559,546	<i>FTL5</i>
2H	611,564,428	
2H	673,850,122	<i>FD</i>
2H	673,851,856	<i>FD</i>
2H	685,787,135	<i>AGL32</i>
2H	685,788,746	<i>AGL32</i>
2H	685,788,836	<i>AGL32</i>
2H	697,166,570	<i>LFY1</i>
2H	697,168,237	<i>LFY1</i>
2H	742,246,169	<i>GA3ox1</i>
2H	742,246,651	<i>GA3ox1</i>
2H	742,248,143	<i>GA3ox1</i>
3H	3,244,232	<i>ELF7</i>
3H	83,331,503	<i>GA3ox2</i>
3H	119,252,315	<i>FT2</i>
3H	548,754,394	<i>GA2ox3</i>
3H	548,755,241	<i>GA2ox3</i>
3H	630,547,167	<i>GA20ox3</i>
3H	634,079,978	<i>GA20ox2</i>
3H	634,081,121	<i>GA20ox2</i>
3H	634,081,556	<i>GA20ox2</i>
3H	634,932,524	<i>CIGARP-2</i>
3H	634,933,639	<i>CIGARP-2</i>

3H	634,933,651	<i>CIGARP-2</i>
3H	699,527,121	<i>GA2betadiox7</i>
3H	699,527,655	<i>GA2betadiox7</i>
3H	699,527,991	<i>GA2betadiox7</i>
4H	6,132,648	<i>GRP7a</i>
4H	16,669,060	<i>SLN1</i>
4H	16,670,109	<i>SLN1</i>
4H	16,671,691	<i>SLN1</i>
4H	60,195,252	<i>GID1L2-8</i>
4H	60,195,395	<i>GID1L2-8</i>
4H	300,701,680	<i>FKF1</i>
4H	467,567,098	<i>BB</i>
4H	581,616,973	<i>GARMP</i>
4H	627,080,516	<i>CMF4</i>
4H	627,080,614	<i>CMF4</i>
4H	645,064,549	<i>FT5</i>
4H	645,065,497	<i>FT5</i>
5H	31,837,959	<i>PIF4</i>
5H	482,215,793	<i>DEP1</i>
5H	533,361,846	
5H	559,462,552	<i>CBF9</i>
5H	559,462,683	<i>CBF9</i>
5H	559,462,764	<i>CBF9</i>
5H	559,673,257	<i>CBF4A</i>
5H	559,673,372	<i>CBF4A</i>
5H	559,673,567	<i>CBF4A</i>
5H	559,687,817	

5H	559,687,961	<i>CBF2A</i>
5H	559,688,580	<i>CBF2A</i>
5H	560,196,083	<i>CBF14</i>
5H	560,196,134	<i>CBF14</i>
5H	560,196,229	<i>CBF14</i>
5H	560,570,288	<i>CBF3</i>
5H	560,571,061	<i>CBF3</i>
5H	560,571,115	<i>CBF3</i>
5H	560,571,147	<i>CBF3</i>
5H	560,586,997	<i>CBF10A</i>
5H	560,588,142	<i>CBF10A</i>
5H	560,588,191	<i>CBF10A</i>
5H	560,588,206	<i>CBF10A</i>
5H	560,588,256	
5H	560,732,097	<i>CBF6</i>
5H	560,732,713	<i>CBF6</i>
5H	565,157,545	<i>PRR95</i>
5H	598,231,895	<i>ADA2</i>
5H	598,564,939	<i>PhyC</i>
5H	599,123,281	<i>BM5 (Vrn-H1)</i>
5H	599,332,514	<i>AGLG1</i>
5H	599,332,735	<i>AGLG1</i>
6H	6,262,431	<i>AGL1</i>
6H	6,264,731	<i>AGL1</i>
6H	6,268,303	<i>AGL1</i>
6H	70,578,602	<i>ZTLb</i>
6H	70,582,296	<i>ZTLb</i>

6H	72,969,182	<i>VEL1</i>
6H	139,882,589	<i>TT16</i>
6H	139,884,132	<i>TT16</i>
6H	374,868,207	<i>TOC1</i>
6H	374,868,982	<i>TOC1</i>
6H	384,632,464	<i>Cry2</i>
6H	384,633,137	<i>Cry2</i>
6H	504,463,075	<i>CO2</i>
6H	504,465,056	<i>CO2</i>
7H	37,608,103	<i>MADS25-2</i>
7H	37,619,514	<i>MADS25-2</i>
7H	37,904,213	<i>MADS25-3</i>
7H	37,905,096	<i>MADS25-3</i>
7H	37,905,206	<i>MADS25-3</i>
7H	49,217,139	<i>CO8</i>
7H	49,217,216	<i>CO8</i>
Un	12,158,311	<i>BM3</i>

Table S3 Mean and standard error of flowering time (Z49) of different trials in Perth in 2019.

Trial	Treatment	Z49	n
April 2019	No	90.2 ± 0.7	185
	Vernalisation	69.3 ± 0.7	188
May 2019	No	97.6 ± 0.5	185
	Vernalisation	84.3 ± 0.6	188
	Extended day length	63.8 ± 0.7	187
June 2019	No	93 ± 0.4	188
	Vernalisation	91.9 ± 0.6	159
July 2019	No	74.8 ± 0.5	137
	Vernalisation	71.4 ± 0.5	115
August 2019	No	66.1 ± 0.3	187
	Vernalisation	64.9 ± 0.5	166

Table S4 Significant quantitative trait nucleotides (QTNs) from Genome-wide association studies for flowering time

Trial	Method	Marker	Chr	Pos	QTN Effect	LOD	Compass	GrangeR	La Trobe	Lockyer
Perth 2017	mrMLM	D2H28394307_TC	2	28394307	1.6	5.84	T	T	C	C
Perth 2017	mrMLM	D2H549652547_CT	2	549652547	-2.84	10.32	C	T	C	C
Perth 2017	mrMLM	D3H497561170_GA	3	497561170	-1.59	3.38	G	A	G	G
Perth 2017	mrMLM	D3H631832650_CG	3	631832650	-2.12	8.03	C	G	C	G
Perth 2017	FASTmrMLM	D2H28394307_TC	2	28394307	1.41	5.84	T	T	C	C
Perth 2017	FASTmrMLM	D2H549652547_CT	2	549652547	-2.65	10.32	C	T	C	C
Perth 2017	FASTmrMLM	D3H497561170_GA	3	497561170	-1.21	3.38	G	A	G	G
Perth 2017	FASTmrMLM	D3H631832650_CG	3	631832650	-2.04	8.03	C	G	C	G
Perth 2017	FASTmrEMMA	D2H28394307_TC	2	28394307	3.23	5.71	T	T	C	C
Perth 2017	FASTmrEMMA	D3H635379323_GC	3	635379323	4.9	9.88	G	C	G	C
Perth 2017	pLARmEB	D2H28394307_TC	2	28394307	1.39	6.49	T	T	C	C
Perth 2017	pLARmEB	D2H549652547_CT	2	549652547	-2.43	9.84	C	T	C	C
Perth 2017	pKWmEB	D1H489138501_GC	1	489138501	0.81	3.69	C	G	G	G
Perth 2017	pKWmEB	D2H549652547_CT	2	549652547	-1.63	6.03	C	T	C	C
Perth 2017	pKWmEB	D3H631680288_GC	3	631680288	-1.49	4.74	C	G	C	G
Perth 2017	ISIS EM-BLASSO	D2H31462699_TG	2	31462699	1.45	5.96	T	T	G	G
Perth 2017	ISIS EM-BLASSO	D2H549652547_CT	2	549652547	-2.55	9.5	C	T	C	C
Perth 2017	ISIS EM-BLASSO	D3H631832650_CG	3	631832650	-2.43	12.18	C	G	C	G
Perth 2019 June Vernalised	mrMLM	D2H525245905_AC	2	525245905	-3.77	5.78	A	C	A	A
Perth 2019 June Vernalised	mrMLM	D3H677376626_CT	3	677376626	-2.95	3.23	C	C	T	C
Perth 2019 June Vernalised	FASTmrEMMA	D3H606013063_CG	3	606013063	-3.98	3	C	G	G	G
Perth 2019 June Vernalised	FASTmrEMMA	D7H118564441_AT	7	118564441	4.96	4.44	T	A	A	T
Perth 2019 June Vernalised	pLARmEB	D2H513396095_CG	2	513396095	-4.12	8.63	C	G	C	C
Perth 2019 June Vernalised	pLARmEB	D5H478394957_AG	5	478394957	-2.3	3.74	G	G	A	G
Perth 2019 June Vernalised	pLARmEB	D7H32776273_GA	7	32776273	1.77	3.08	A	G	A	G
Perth 2019 June Vernalised	pKWmEB	D2H513396095_CG	2	513396095	-2.82	5.14	C	G	C	C

Perth 2019 June Vernalised	ISIS EM-BLASSO	D2H549094482_GA	2	549094482	-3.69	8.3	A	G	A	A
Perth 2019 June Vernalised	ISIS EM-BLASSO	D3H677376626_CT	3	677376626	-2.31	3.79	C	C	T	C
Perth 2019 June Vernalised	ISIS EM-BLASSO	D5H478394957_AG	5	478394957	-2.27	4.15	G	G	A	G
Perth 2019 June Vernalised	ISIS EM-BLASSO	D7H32776273_GA	7	32776273	2	3.85	A	G	A	G
Perth 2019 July Vernalised	FASTmrEMMA	D2H20093178_TC	2	20093178	-4.49	3.56	C	T	T	C
Perth 2019 July Vernalised	pLARmEB	K1H538165591_GA	1	538165591	1.09	3.15	G	G	A	A
Perth 2019 July Vernalised	pLARmEB	D1H548125741_CT	1	548125741	-1.92	3.39	C	C	T	C
Perth 2019 July Vernalised	pLARmEB	D2H271995988_TC	2	271995988	2.35	6.42	T	C	T	T
Perth 2019 July Vernalised	pLARmEB	D5H617105681_AT	5	617105681	-1.22	4.6	A	A	T	T
Perth 2019 July Vernalised	pLARmEB	D5H651511097_CG	5	651511097	1.43	4.29	C	C	G	C
Perth 2019 July Vernalised	pLARmEB	D7H625140060_AG	7	625140060	2.06	3.46	G	A	G	G
Perth 2019 July Vernalised	ISIS EM-BLASSO	K1H538165591_GA	1	538165591	1.45	3.77	G	G	A	A
Perth 2019 July Vernalised	ISIS EM-BLASSO	D7H625140060_AG	7	625140060	2.5	3.68	G	A	G	G
Perth 2019 August Vernalised	mrMLM	D1H1421695_AC	1	1421695	2.5	3.26	C	A	C	C
Perth 2019 August Vernalised	mrMLM	D1H554606691_AC	1	554606691	-2.12	3.33	C	A	A	A
Perth 2019 August Vernalised	mrMLM	D2H37222451_AG	2	37222451	-1.94	3.71	G	G	A	A
Perth 2019 August Vernalised	mrMLM	D5H600471239_AC	5	600471239	-2.69	3.36	C	A	A	A
Perth 2019 August Vernalised	FASTmrMLM	D2H37222451_AG	2	37222451	-1.48	3.56	G	G	A	A
Perth 2019 August Vernalised	FASTmrEMMA	D2H432062575_GA	2	432062575	4.41	3.48	G	A	G	G
Perth 2019 August Vernalised	pLARmEB	D2H37222451_AG	2	37222451	-1.24	3.27	G	G	A	A
Perth 2019 August Vernalised	ISIS EM-BLASSO	D2H432062575_GA	2	432062575	2.36	4.34	G	A	G	G
Perth 2019 August Vernalised	ISIS EM-BLASSO	D5H390501082_TG	5	390501082	-2.26	3.26	T	T	G	T
Esperance 2018	mrMLM	D1H4653106_AG	1	4653106	1.72	3.1	G	A	G	A
Esperance 2018	mrMLM	D2H541882594_TG	2	541882594	-2.98	5.59	G	T	G	G
Esperance 2018	mrMLM	D2H29454480_AC	2	29454480	4.85	19.71	C	C	A	A
Esperance 2018	mrMLM	D3H631832727_GC	3	631832727	3.88	13.41	G	C	G	C
Esperance 2018	mrMLM	D7H37802896_AG	7	37802896	3.29	9.53	A	G	A	G
Esperance 2018	FASTmrMLM	D1H4653106_AG	1	4653106	2.01	5.62	G	A	G	A
Esperance 2018	FASTmrMLM	D2H29454480_AC	2	29454480	4.71	17.32	C	C	A	A

Esperance 2018	FASTmrMLM	D3H631680288_GC	3	631680288	-3.93	13.8	C	G	C	G
Esperance 2018	FASTmrMLM	D7H40095600_TC	7	40095600	-3.26	9.16	T	C	T	C
Esperance 2018	FASTmrEMMA	D1H4653106_AG	1	4653106	3.01	3.5	G	A	G	A
Esperance 2018	FASTmrEMMA	D2H29564269_TC	2	29564269	-9.29	18.46	C	C	T	T
Esperance 2018	FASTmrEMMA	D2H585450069_GA	2	585450069	4.76	4.51	G	A	G	G
Esperance 2018	FASTmrEMMA	D3H631832727_GC	3	631832727	7.45	12.77	G	C	G	C
Esperance 2018	FASTmrEMMA	D7H40095600_TC	7	40095600	-5.89	8.35	T	C	T	C
Esperance 2018	pLARmEB	D1H4653106_AG	1	4653106	1.55	4.82	G	A	G	A
Esperance 2018	pLARmEB	D2H29454480_AC	2	29454480	4.58	22.85	C	C	A	A
Esperance 2018	pLARmEB	D2H541882594_TG	2	541882594	-2.84	5.93	G	T	G	G
Esperance 2018	pLARmEB	D3H631832727_GC	3	631832727	3.81	17.68	G	C	G	C
Esperance 2018	pLARmEB	D5H430868101_AG	5	430868101	-2.5	4.49	G	A	A	A
Esperance 2018	pLARmEB	K5H559462552_AG	5	559462552	1.13	3.38	G	A	A	A
Esperance 2018	pLARmEB	D5H597950604_TC	5	597950604	0	3.56	T	C	T	T
Esperance 2018	pLARmEB	D7H40095600_TC	7	40095600	-2.64	8.42	T	C	T	C
Esperance 2018	pKWmEB	D1H4653106_AG	1	4653106	1.86	6.43	G	A	G	A
Esperance 2018	pKWmEB	D2H29454480_AC	2	29454480	5	19.35	C	C	A	A
Esperance 2018	pKWmEB	D2H38574929_AG	2	38574929	-2.07	4.78	G	A	A	A
Esperance 2018	pKWmEB	D2H271999272_GA	2	271999272	1.91	4.04	G	A	G	G
Esperance 2018	pKWmEB	D3H631680288_GC	3	631680288	-2.08	6.14	C	G	C	G
Esperance 2018	pKWmEB	D4H510209595_GA	4	510209595	-1.95	5.38	G	G	G	A
Esperance 2018	pKWmEB	D5H587440727_CT	5	587440727	1.37	3.82	C	T	C	C
Esperance 2018	pKWmEB	D6H6216705_CT	6	6216705	-1.35	3.95	T	T	C	T
Esperance 2018	ISIS EM-BLASSO	D1H4653106_AG	1	4653106	1.66	5.56	G	A	G	A
Esperance 2018	ISIS EM-BLASSO	D2H29454480_AC	2	29454480	4.71	25.11	C	C	A	A
Esperance 2018	ISIS EM-BLASSO	D3H631832727_GC	3	631832727	3.76	17.43	G	C	G	C
Esperance 2018	ISIS EM-BLASSO	D5H45772858_TC	5	45772858	-1.27	3.52	T	T	C	T
Esperance 2018	ISIS EM-BLASSO	K5H559462552_AG	5	559462552	1.14	3.87	G	A	A	A
Esperance 2018	ISIS EM-BLASSO	D5H590274735_GA	5	590274735	1.81	4.85	A	G	G	G

Esperance 2018	ISIS EM-BLASSO	D5H597800435_CT	5	597800435	1.45	4.36	C	T	C	C
Esperance 2018	ISIS EM-BLASSO	D7H37802896_AG	7	37802896	2.55	6.86	A	G	A	G
Corrigin 2018	mrMLM	D1H4653106_AG	1	4653106	1.62	4.8	G	A	G	A
Corrigin 2018	mrMLM	D2H29454480_AC	2	29454480	1.74	4.3	C	C	A	A
Corrigin 2018	mrMLM	D3H631832727_GC	3	631832727	3.3	10.71	G	C	G	C
Corrigin 2018	mrMLM	D7H37802896_AG	7	37802896	2.42	6.15	A	G	A	G
Corrigin 2018	FASTmrMLM	D1H4653106_AG	1	4653106	1.44	4.57	G	A	G	A
Corrigin 2018	FASTmrMLM	D1H5762961_GA	1	5762961	0.72	3.01	G	G	A	A
Corrigin 2018	FASTmrMLM	D2H29454480_AC	2	29454480	1.51	4.56	C	C	A	A
Corrigin 2018	FASTmrMLM	D3H631832650_CG	3	631832650	-2.89	10.86	C	G	C	G
Corrigin 2018	FASTmrMLM	D7H37802896_AG	7	37802896	2.05	6.11	A	G	A	G
Corrigin 2018	FASTmrEMMA	D3H634804408_CA	3	634804408	5.1	5.85	C	C	C	A
Corrigin 2018	pLARmEB	D1H4653106_AG	1	4653106	1.28	3.99	G	A	G	A
Corrigin 2018	pLARmEB	D2H29454480_AC	2	29454480	1.57	5.72	C	C	A	A
Corrigin 2018	pLARmEB	D2H57616692_GC	2	57616692	0.96	3.08	G	C	C	C
Corrigin 2018	pLARmEB	D3H631832727_GC	3	631832727	2.82	11.88	G	C	G	C
Corrigin 2018	pLARmEB	D5H430868101_AG	5	430868101	-1.42	3.18	G	A	A	A
Corrigin 2018	pLARmEB	D7H37802896_AG	7	37802896	1.87	5.63	A	G	A	G
Corrigin 2018	ISIS EM-BLASSO	D2H29454480_AC	2	29454480	1.84	6.96	C	C	A	A
Corrigin 2018	ISIS EM-BLASSO	D2H57616692_GC	2	57616692	1.25	4.24	G	C	C	C
Corrigin 2018	ISIS EM-BLASSO	D2H543959347_TC	2	543959347	1.32	3.42	T	C	T	T
Corrigin 2018	ISIS EM-BLASSO	D3H631832650_CG	3	631832650	-2.94	10.69	C	G	C	G
Corrigin 2018	ISIS EM-BLASSO	D5H430868101_AG	5	430868101	-1.94	4.72	G	A	A	A
Corrigin 2018	ISIS EM-BLASSO	D7H37802896_AG	7	37802896	1.71	4.72	A	G	A	G
Perth 2019 Extended photoperiod	mrMLM	D2H38635094_TC	2	38635094	5.04	3.5	C	C	T	T
Perth 2019 Extended photoperiod	FASTmrMLM	D2H38635094_TC	2	38635094	2.31	3.4	C	C	T	T
Perth 2019 Extended photoperiod	FASTmrEMMA	D2H38635094_TC	2	38635094	5.31	3.53	C	C	T	T

Perth 2019 Extended photoperiod	pLARmEB	D2H38635094_TC	2	38635094	2.31	3.4	C	C	T	T
Perth 2019 Extended photoperiod	pKWmEB	K2H29123942_AG	2	29123942	4.26	9.5	A	A	G	G
Perth 2019 Extended photoperiod	pKWmEB	D2H38635094_TC	2	38635094	2.1	3.5	C	C	T	T
Perth 2019 Extended photoperiod	ISIS EM-BLASSO	D2H38635094_TC	2	38635094	2.32	3.53	C	C	T	T
Vernalised/Non-Vernalised April	FASTmrMLM	D5H595203077_GA	5	595203077	-1.92	3.96	G	A	G	G
Vernalised/Non-Vernalised April	FASTmrEMMA	D5H595203077_GA	5	595203077	-3.49	3.35	G	A	G	G
Vernalised/Non-Vernalised April	pLARmEB	D5H595203077_GA	5	595203077	-1.92	3.92	G	A	G	G
Vernalised/Non-Vernalised April	pKWmEB	D5H595203077_GA	5	595203077	-1.44	3.14	G	A	G	G
Vernalised/Non-Vernalised April	ISIS EM-BLASSO	D5H587440733_AG	5	587440733	1.62	3.61	A	G	A	A
Vernalised/Non-Vernalised May	FASTmrEMMA	D2H638903073_TG	2	638903073	-3.76	3.24	T	G	T	T
Vernalised/Non-Vernalised May	ISIS EM-BLASSO	D2H639289577_GA	2	639289577	2.02	3.54	A	G	A	A
Perth 2018	mrMLM	D2H29454480_AC	2	29454480	3.29	14.83	C	C	A	A
Perth 2018	mrMLM	D2H543959347_TC	2	543959347	3.7	12.44	T	C	T	T
Perth 2018	mrMLM	D3H631832650_CG	3	631832650	-3.07	12.69	C	G	C	G
Perth 2018	mrMLM	K5H482215793_IndelC_CA	5	482215793	-2.23	3.98	C	C	A	C
Perth 2018	FASTmrMLM	D2H29454480_AC	2	29454480	3.11	15.44	C	C	A	A
Perth 2018	FASTmrMLM	D2H543959347_TC	2	543959347	3.5	12.05	T	C	T	T
Perth 2018	FASTmrMLM	D3H631832650_CG	3	631832650	-2.95	11.87	C	G	C	G
Perth 2018	FASTmrMLM	K5H482215793_IndelC_CA	5	482215793	-1.73	3.93	C	C	A	C
Perth 2018	FASTmrEMMA	D2H29564269_TC	2	29564269	-5.66	12.37	C	C	T	T
Perth 2018	FASTmrEMMA	D2H543959347_TC	2	543959347	6.5	10.45	T	C	T	T
Perth 2018	pLARmEB	D2H29454480_AC	2	29454480	2.85	13.72	C	C	A	A
Perth 2018	pLARmEB	D2H408967031_AG	2	408967031	-3.32	10.62	A	G	A	A
Perth 2018	pLARmEB	D2H748648671_AG	2	748648671	-1	3.73	A	A	A	G
Perth 2018	pLARmEB	D3H631812217_AG	3	631812217	3	13.49	G	A	G	A

Perth 2018	pLARmEB	D7H425661183_CT	7	425661183	1.29	3.96	T	C	T	C
Perth 2018	pKWmEB	D2H29564269_TC	2	29564269	-2.51	8.15	C	C	T	T
Perth 2018	pKWmEB	D2H532292036_TC	2	532292036	2.27	6.93	T	C	T	T
Perth 2018	pKWmEB	D3H631832650_CG	3	631832650	-2.17	9.02	C	G	C	G
Perth 2018	ISIS EM-BLASSO	D2H29454480_AC	2	29454480	2.87	14.19	C	C	A	A
Perth 2018	ISIS EM-BLASSO	D2H546665244_TC	2	546665244	3.17	11.71	T	C	T	T
Perth 2018	ISIS EM-BLASSO	D3H631832650_CG	3	631832650	-3.03	14.72	C	G	C	G
Perth 2018	ISIS EM-BLASSO	D4H473895443_AC	4	473895443	1.56	4.59	A	C	C	C
Perth 2018	ISIS EM-BLASSO	D5H39817622_AG	5	39817622	-1.25	3.15	G	G	A	G
Perth 2018	ISIS EM-BLASSO	D5H628711504_GA	5	628711504	-1.19	4.18	A	A	G	A
Perth April 2019	mrMLM	D2H549094482_GA	2	549094482	-5.19	9.47	A	G	A	A
Perth April 2019	mrMLM	D2H31462699_TG	2	31462699	4.06	9.65	T	T	G	G
Perth April 2019	mrMLM	K2H685788836_CG	2	685788836	3.14	3.92	C	G	G	C
Perth April 2019	mrMLM	D5H478394957_AG	5	478394957	-4.48	6.22	G	G	A	G
Perth April 2019	mrMLM	D7H32776273_GA	7	32776273	4.85	8.39	A	G	A	G
Perth April 2019	FASTmrMLM	D2H31462699_TG	2	31462699	3.72	11.17	T	T	G	G
Perth April 2019	FASTmrMLM	D2H549094482_GA	2	549094482	-4.84	8.97	A	G	A	A
Perth April 2019	FASTmrMLM	K2H685788836_CG	2	685788836	2.51	3.62	C	G	G	C
Perth April 2019	FASTmrMLM	D5H478394957_AG	5	478394957	-3.92	6.25	G	G	A	G
Perth April 2019	FASTmrMLM	D7H32776273_GA	7	32776273	4.42	8.33	A	G	A	G
Perth April 2019	FASTmrEMMA	D2H498405412_AG	2	498405412	9.48	9.22	G	A	G	G
Perth April 2019	FASTmrEMMA	K3H634079978_GA	3	634079978	5.53	4.82	G	G	G	A
Perth April 2019	FASTmrEMMA	D5H478394957_AG	5	478394957	-9.41	8.21	G	G	A	G
Perth April 2019	FASTmrEMMA	D7H32776273_GA	7	32776273	7.82	6.9	A	G	A	G
Perth April 2019	pLARmEB	D2H31462699_TG	2	31462699	3.44	10.57	T	T	G	G
Perth April 2019	pLARmEB	D2H549094482_GA	2	549094482	-5.07	10.63	A	G	A	A
Perth April 2019	pLARmEB	K3H634079978_GA	3	634079978	3.06	6.05	G	G	G	A
Perth April 2019	pLARmEB	D5H478394957_AG	5	478394957	-4.57	8.89	G	G	A	G
Perth April 2019	pLARmEB	D5H587440733_AG	5	587440733	1.59	3.61	A	G	A	A

Perth April 2019	pLARmEB	D7H32776273_GA	7	32776273	3.99	7.18	A	G	A	G
Perth April 2019	pKWmEB	D2H29454480_AC	2	29454480	3.27	6.87	C	C	A	A
Perth April 2019	pKWmEB	D2H402416491_AC	2	402416491	-3.26	5.22	A	C	A	A
Perth April 2019	pKWmEB	D5H478394957_AG	5	478394957	-3.51	5.76	G	G	A	G
Perth April 2019	ISIS EM-BLASSO	D2H29454480_AC	2	29454480	3.71	9.41	C	C	A	A
Perth April 2019	ISIS EM-BLASSO	D2H549094482_GA	2	549094482	-5.16	12.3	A	G	A	A
Perth April 2019	ISIS EM-BLASSO	K3H634079978_GA	3	634079978	2.81	5.38	G	G	G	A
Perth April 2019	ISIS EM-BLASSO	D5H478394957_AG	5	478394957	-4.71	9.47	G	G	A	G
Perth April 2019	ISIS EM-BLASSO	D5H587440733_AG	5	587440733	1.52	3.18	A	G	A	A
Perth April 2019	ISIS EM-BLASSO	D7H32776273_GA	7	32776273	3.77	6.56	A	G	A	G
Perth May 2019	mrMLM	D2H29454480_AC	2	29454480	3.16	9.3	C	C	A	A
Perth May 2019	mrMLM	D3H634804408_CA	3	634804408	2.48	5.53	C	C	C	A
Perth May 2019	mrMLM	K5H482215793_IndelC_CA	5	482215793	-3.33	5.84	C	C	A	C
Perth May 2019	mrMLM	D7H40095600_TC	7	40095600	-2.11	3.77	T	C	T	C
Perth May 2019	FASTmrMLM	D2H29454480_AC	2	29454480	2.9	9.31	C	C	A	A
Perth May 2019	FASTmrMLM	D3H634804408_CA	3	634804408	2.13	5.53	C	C	C	A
Perth May 2019	FASTmrMLM	K5H482215793_IndelC_CA	5	482215793	-2.83	5.84	C	C	A	C
Perth May 2019	FASTmrMLM	D7H40095600_TC	7	40095600	-1.65	3.78	T	C	T	C
Perth May 2019	FASTmrEMMA	D2H29564269_TC	2	29564269	-5.52	8.84	C	C	T	T
Perth May 2019	FASTmrEMMA	D3H634804408_CA	3	634804408	4.34	5.55	C	C	C	A
Perth May 2019	FASTmrEMMA	D7H40095600_TC	7	40095600	-3.4	3.94	T	C	T	C
Perth May 2019	pLARmEB	D2H29454480_AC	2	29454480	3.02	12.4	C	C	A	A
Perth May 2019	pLARmEB	D2H549094482_GA	2	549094482	-2.28	5.33	A	G	A	A
Perth May 2019	pLARmEB	D3H79426134_GT	3	79426134	-1.72	3.58	T	G	T	T
Perth May 2019	pLARmEB	D3H634804408_CA	3	634804408	1.97	5.96	C	C	C	A
Perth May 2019	pLARmEB	K5H482215793_IndelC_CA	5	482215793	-3.08	8.07	C	C	A	C
Perth May 2019	pLARmEB	D7H111614504_TC	7	111614504	-0.92	3.04	C	T	T	T
Perth May 2019	pKWmEB	D2H29454480_AC	2	29454480	2.35	6.69	C	C	A	A
Perth May 2019	pKWmEB	D2H592062371_GA	2	592062371	0.98	3.15	G	A	G	A

Perth May 2019	pKWmEB	D5H382294832_AG	5	382294832	-2.31	3.67	G	G	A	G
Perth May 2019	ISIS EM-BLASSO	D2H29454480_AC	2	29454480	3.02	13.15	C	C	A	A
Perth May 2019	ISIS EM-BLASSO	D2H546665244_TC	2	546665244	2.56	7.03	T	C	T	T
Perth May 2019	ISIS EM-BLASSO	D3H634804408_CA	3	634804408	2.06	6.77	C	C	C	A
Perth May 2019	ISIS EM-BLASSO	K5H482215793_IndelC_CA	5	482215793	-2.18	3.13	C	C	A	C
Perth May 2019	ISIS EM-BLASSO	D7H111614504_TC	7	111614504	-1.02	3.48	C	T	T	T
Per June 2019	mrMLM	D2H519658782_AC	2	519658782	3.99	17.34	C	A	C	C
Per June 2019	mrMLM	D3H631680288_GC	3	631680288	-1.61	4.93	C	G	C	G
Per June 2019	mrMLM	K5H482215793_IndelC_CA	5	482215793	-1.84	3.57	C	C	A	C
Per June 2019	mrMLM	D7H37802896_AG	7	37802896	2.03	6.92	A	G	A	G
Per June 2019	FASTmrMLM	D2H519658782_AC	2	519658782	3.99	17.34	C	A	C	C
Per June 2019	FASTmrMLM	D3H631680288_GC	3	631680288	0	4.93	C	G	C	G
Per June 2019	FASTmrMLM	K5H482215793_IndelC_CA	5	482215793	-1.58	3.57	C	C	A	C
Per June 2019	FASTmrMLM	D7H37802896_AG	7	37802896	1.55	6.92	A	G	A	G
Per June 2019	FASTmrEMMA	D2H519658782_AC	2	519658782	7.95	18.29	C	A	C	C
Per June 2019	FASTmrEMMA	D3H634581648_GA	3	634581648	3.13	5.18	G	G	G	A
Per June 2019	FASTmrEMMA	K5H482215793_IndelC_CA	5	482215793	-3.14	4.02	C	C	A	C
Per June 2019	FASTmrEMMA	D7H37802896_AG	7	37802896	3.24	5.88	A	G	A	G
Per June 2019	pLARmEB	D3H631680288_GC	3	631680288	-1.37	5.07	C	G	C	G
Per June 2019	pLARmEB	K5H482215793_IndelC_CA	5	482215793	-1.43	3.64	C	C	A	C
Per June 2019	pLARmEB	D7H37802896_AG	7	37802896	1.81	6.85	A	G	A	G
Per June 2019	pKWmEB	D2H408967031_AG	2	408967031	-3.13	11.37	A	G	A	A
Per June 2019	ISIS EM-BLASSO	D2H519658782_AC	2	519658782	3.87	16.59	C	A	C	C
Per June 2019	ISIS EM-BLASSO	D3H631680288_GC	3	631680288	-1.37	4.95	C	G	C	G
Per June 2019	ISIS EM-BLASSO	K5H482215793_IndelC_CA	5	482215793	-1.43	3.73	C	C	A	C
Per June 2019	ISIS EM-BLASSO	D7H37802896_AG	7	37802896	1.81	7	A	G	A	G
Perth July 2019	mrMLM	K5H482215793_IndelC_CA	5	482215793	-4.23	5.9	C	C	A	C
Perth July 2019	mrMLM	D7H20324931_GA	7	20324931	3.24	5.23	A	G	A	G
Perth July 2019	FASTmrMLM	K5H482215793_IndelC_CA	5	482215793	-3.86	3.3	C	C	A	C

Perth July 2019	FASTmrMLM	D7H20324931_GA	7	20324931	2.74	5.43	A	G	A	G
Perth July 2019	FASTmrEMMA	D7H20324931_GA	7	20324931	5.46	5.69	A	G	A	G
Perth July 2019	pLARmEB	D2H513396095_CG	2	513396095	-1.78	3.34	C	G	C	C
Perth July 2019	pLARmEB	K5H482215793_IndelC_CA	5	482215793	-2.97	4.22	C	C	A	C
Perth July 2019	pLARmEB	D7H20324931_GA	7	20324931	2.53	4.74	A	G	A	G
Perth July 2019	ISIS EM-BLASSO	D2H128357515_AT	2	128357515	1.68	3.23	T	A	T	T
Perth July 2019	ISIS EM-BLASSO	D5H42145240_AG	5	42145240	2.63	3.28	A	A	G	A
Perth July 2019	ISIS EM-BLASSO	K5H482215793_IndelC_CA	5	482215793	-2.79	4.06	C	C	A	C
Perth July 2019	ISIS EM-BLASSO	D7H20324931_GA	7	20324931	2.59	4.89	A	G	A	G
Perth August 2019	mrMLM	K2H29123942_AG	2	29123942	2.02	11.05	A	A	G	G
Perth August 2019	mrMLM	D2H569508108_TC	2	569508108	2.35	9.36	T	C	T	T
Perth August 2019	mrMLM	D4H580004566_AG	4	580004566	2.44	4.93	A	A	A	G
Perth August 2019	FASTmrMLM	K2H29123942_AG	2	29123942	1.61	7.68	A	A	G	G
Perth August 2019	FASTmrMLM	D2H569508108_TC	2	569508108	1.77	6.65	T	C	T	T
Perth August 2019	FASTmrMLM	D6H511517814_AG	6	511517814	1.05	3.98	A	A	A	G
Perth August 2019	FASTmrMLM	D7H37802896_AG	7	37802896	1.03	4.29	A	G	A	G
Perth August 2019	FASTmrEMMA	K2H29123942_AG	2	29123942	3.29	7.95	A	A	G	G
Perth August 2019	FASTmrEMMA	D2H569508108_TC	2	569508108	3.57	6.72	T	C	T	T
Perth August 2019	FASTmrEMMA	D6H506826032_CT	6	506826032	-2.05	3.74	T	T	T	C
Perth August 2019	FASTmrEMMA	D7H37802896_AG	7	37802896	1.95	4.01	A	G	A	G
Perth August 2019	pLARmEB	K2H29123942_AG	2	29123942	1.41	6.67	A	A	G	G
Perth August 2019	pLARmEB	D2H402416491_AC	2	402416491	-1.5	5.41	A	C	A	A
Perth August 2019	pLARmEB	D5H579459306_CA	5	579459306	0.96	3.69	C	A	C	C
Perth August 2019	pLARmEB	D6H511517814_AG	6	511517814	1.27	6.05	A	A	A	G
Perth August 2019	pLARmEB	D7H37802896_AG	7	37802896	1.01	3.94	A	G	A	G
Perth August 2019	pLARmEB	D7H601732139_CG	7	601732139	0.82	4.35	C	C	G	G
Perth August 2019	pLARmEB	D7H635235854_CG	7	635235854	0.9	4.47	G	G	C	C
Perth August 2019	pKWmEB	K2H29123942_AG	2	29123942	1.67	8.94	A	A	G	G
Perth August 2019	pKWmEB	D4H578442430_CT	4	578442430	1.41	6.79	C	C	C	T

Perth August 2019	pKWmEB	D6H516794731_TC	6	516794731	0	4.87	T	C	C	T
Perth August 2019	pKWmEB	D6H22764172_TC	6	22764172	0	3.06	T	C	T	T
Perth August 2019	ISIS EM-BLASSO	K2H29123942_AG	2	29123942	1.84	12.55	A	A	G	G
Perth August 2019	ISIS EM-BLASSO	D2H569508108_TC	2	569508108	1.96	8.48	T	C	T	T
Perth August 2019	ISIS EM-BLASSO	D4H578442430_CT	4	578442430	1.63	3.74	C	C	C	T
Perth April 2019 Vernalised	mrMLM	D2H31462699_TG	2	31462699	3.22	5.57	T	T	G	G
Perth April 2019 Vernalised	mrMLM	D2H513396095_CG	2	513396095	-5.1	9.26	C	G	C	C
Perth April 2019 Vernalised	mrMLM	D3H631832727_GC	3	631832727	3.59	9.93	G	C	G	C
Perth April 2019 Vernalised	mrMLM	D6H5210171_TA	6	5210171	3.77	5.01	T	A	T	A
Perth April 2019 Vernalised	mrMLM	D7H40095600_TC	7	40095600	-3.94	7.98	T	C	T	C
Perth April 2019 Vernalised	FASTmrMLM	D2H31462699_TG	2	31462699	2.54	5.73	T	T	G	G
Perth April 2019 Vernalised	FASTmrMLM	D2H498405412_AG	2	498405412	4.89	11.15	G	A	G	G
Perth April 2019 Vernalised	FASTmrMLM	D3H631832727_GC	3	631832727	4	11.32	G	C	G	C
Perth April 2019 Vernalised	FASTmrMLM	D5H562614128_GC	5	562614128	2.51	3.61	C	G	C	C
Perth April 2019 Vernalised	FASTmrMLM	D6H5210171_TA	6	5210171	3.34	5.2	T	A	T	A
Perth April 2019 Vernalised	FASTmrMLM	D7H40095600_TC	7	40095600	-3.69	8.5	T	C	T	C
Perth April 2019 Vernalised	FASTmrEMMA	D2H498405412_AG	2	498405412	10.09	10.07	G	A	G	G
Perth April 2019 Vernalised	FASTmrEMMA	D3H631832727_GC	3	631832727	6.44	6.79	G	C	G	C
Perth April 2019 Vernalised	FASTmrEMMA	D6H5210171_TA	6	5210171	5.56	3.85	T	A	T	A
Perth April 2019 Vernalised	FASTmrEMMA	D7H40095600_TC	7	40095600	-7.47	7.75	T	C	T	C
Perth April 2019 Vernalised	pLARmEB	D2H31462699_TG	2	31462699	2.68	6.93	T	T	G	G
Perth April 2019 Vernalised	pLARmEB	D2H513396095_CG	2	513396095	-5.32	13.66	C	G	C	C
Perth April 2019 Vernalised	pLARmEB	D3H631832727_GC	3	631832727	3.75	10.57	G	C	G	C
Perth April 2019 Vernalised	pLARmEB	D4H502678478_CT	4	502678478	2.22	4.58	C	T	T	T
Perth April 2019 Vernalised	pLARmEB	D5H562614128_GC	5	562614128	2.96	4.79	C	G	C	C
Perth April 2019 Vernalised	pLARmEB	D6H5210171_TA	6	5210171	3.5	5.96	T	A	T	A
Perth April 2019 Vernalised	pLARmEB	D7H40095600_TC	7	40095600	-2.97	5.81	T	C	T	C
Perth April 2019 Vernalised	pKWmEB	D2H29454480_AC	2	29454480	2.77	4.98	C	C	A	A
Perth April 2019 Vernalised	pKWmEB	D2H498405412_AG	2	498405412	4.21	9.35	G	A	G	G

Perth April 2019 Vernalised	pKWmEB	D3H631832727_GC	3	631832727	2.28	4.76	G	C	G	C
Perth April 2019 Vernalised	pKWmEB	D7H40095600_TC	7	40095600	-2.42	4.93	T	C	T	C
Perth April 2019 Vernalised	ISIS EM-BLASSO	D1H108240893_TG	1	108240893	-1.33	3.03	G	G	T	T
Perth April 2019 Vernalised	ISIS EM-BLASSO	D2H31462699_TG	2	31462699	2.65	6.14	T	T	G	G
Perth April 2019 Vernalised	ISIS EM-BLASSO	D2H453687559_TC	2	453687559	-4.77	10.07	C	T	C	C
Perth April 2019 Vernalised	ISIS EM-BLASSO	D3H631832727_GC	3	631832727	3.91	10.85	G	C	G	C
Perth April 2019 Vernalised	ISIS EM-BLASSO	D5H562614128_GC	5	562614128	2.46	3.62	C	G	C	C
Perth April 2019 Vernalised	ISIS EM-BLASSO	D6H5210171_TA	6	5210171	3.63	6.4	T	A	T	A
Perth April 2019 Vernalised	ISIS EM-BLASSO	D7H40095600_TC	7	40095600	-3.33	6.92	T	C	T	C
Perth May 2019 Vernalised	mrMLM	D2H31462699_TG	2	31462699	3.36	6.7	T	T	G	G
Perth May 2019 Vernalised	mrMLM	D2H696974995_GA	2	696974995	2.92	3.02	G	A	G	G
Perth May 2019 Vernalised	mrMLM	D3H631680288_GC	3	631680288	-3.16	5.16	C	G	C	G
Perth May 2019 Vernalised	FASTmrMLM	D2H31462699_TG	2	31462699	2.9	6.7	T	T	G	G
Perth May 2019 Vernalised	FASTmrMLM	D2H696974995_GA	2	696974995	2.09	3.02	G	A	G	G
Perth May 2019 Vernalised	FASTmrMLM	D3H631680288_GC	3	631680288	-2.79	5.16	C	G	C	G
Perth May 2019 Vernalised	FASTmrEMMA	D2H28501872_CT	2	28501872	5.03	4.74	T	T	C	C
Perth May 2019 Vernalised	FASTmrEMMA	D2H585450069_GA	2	585450069	6.48	5.05	G	A	G	G
Perth May 2019 Vernalised	pLARmEB	D2H28501872_CT	2	28501872	2.23	4.09	T	T	C	C
Perth May 2019 Vernalised	pLARmEB	D2H569508108_TC	2	569508108	2.65	3.83	T	C	T	T
Perth May 2019 Vernalised	pLARmEB	D3H631680288_GC	3	631680288	-2.69	5.73	C	G	C	G
Perth May 2019 Vernalised	pLARmEB	D7H30983729_GA	7	30983729	2.49	4.08	A	G	A	G
Perth May 2019 Vernalised	pKWmEB	D2H547422026_CA	2	547422026	-2.19	4.75	A	C	A	A
Perth May 2019 Vernalised	pKWmEB	D2H29564269_TC	2	29564269	-2.45	4.41	C	C	T	T
Perth May 2019 Vernalised	pKWmEB	D3H631680288_GC	3	631680288	-1.69	3.78	C	G	C	G
Perth May 2019 Vernalised	ISIS EM-BLASSO	D2H29564269_TC	2	29564269	-2.83	6.65	C	C	T	T
Perth May 2019 Vernalised	ISIS EM-BLASSO	D2H570296260_TC	2	570296260	-2.87	4.8	C	T	C	C
Perth May 2019 Vernalised	ISIS EM-BLASSO	D2H703934445_CT	2	703934445	-1.87	3.16	C	T	C	C
Perth May 2019 Vernalised	ISIS EM-BLASSO	D3H631680288_GC	3	631680288	-2.82	6.22	C	G	C	G
Perth May 2019 Vernalised	ISIS EM-BLASSO	D7H30983729_GA	7	30983729	2.54	4.29	A	G	A	G

Table S5 Mean and standard error of flowering time (Z49) of different genotypes of the D2H519658782_AC QTN in different trials

Location	Sowing time	Treatment	Genotype	
			A	C
Corrigin	May 2018	No	102.8 ± 0.7	99.1 ± 0.4
Esperance	May 2018	No	108.6 ± 1.5	101.3 ± 0.6
	May 2017	No	104.5 ± 0.7	98.6 ± 0.4
	May 2018	No	103.8 ± 0.9	96.3 ± 0.5
	April 2019	No	98.4 ± 1.8	88.4 ± 0.8
Perth	May 2019	Vernalisation	79.3 ± 2.0	67.1 ± 0.7
		No	101.6 ± 1.2	96.6 ± 0.5
	May 2019	Vernalisation	91.5 ± 1.5	82.8 ± 0.7
		Extended photoperiod	69.4 ± 1.8	62.7 ± 0.8
	June 2019	No	100.2 ± 0.9	91.3 ± 0.4
		Vernalisation	100.1 ± 1.1	90.1 ± 0.5
	July 2019	No	78.3 ± 0.9	73.9 ± 0.5
		Vernalisation	76 ± 0.8	70.4 ± 0.4
	August 2019	No	69.3 ± 0.7	65.4 ± 0.3
		Vernalisation	68.9 ± 1.0	64.1 ± 0.5

Table S6 Mean and standard error of flowering time (Z49) of different genotypes of the D2H29454480_AC QTN in different trials

Location	Sowing time	Treatment	Genotype	
			A	C
Corrigin	May 2018	No	101.8 ± 0.4	98.2 ± 0.8
Esperance	May 2018	No	106.4 ± 0.7	97.0 ± 1.0
	May 2017	No	101.2 ± 0.5	98.4 ± 0.8
	May 2018	No	100.1 ± 0.6	94.7 ± 0.8
	April 2019	No	93.9 ± 0.9	86.0 ± 1.2
Perth	May 2019	Vernalisation	72.9 ± 1.0	65.0 ± 1.0
		No	100.2 ± 0.6	94.6 ± 0.8
	May 2019	Vernalisation	87.1 ± 0.7	81.1 ± 1.2
		Extended photoperiod	58.6 ± 0.6	72.9 ± 1.2
	June 2019	No	93.6 ± 0.5	92.7 ± 0.6
		Vernalisation	92.1 ± 0.8	92.0 ± 1.0
	July 2019	No	74.9 ± 0.6	74.7 ± 0.9
		Vernalisation	71.9 ± 0.6	70.5 ± 0.6
	August 2019	No	65.0 ± 0.4	68.5 ± 0.6
		Vernalisation	64.7 ± 0.6	65.8 ± 0.8

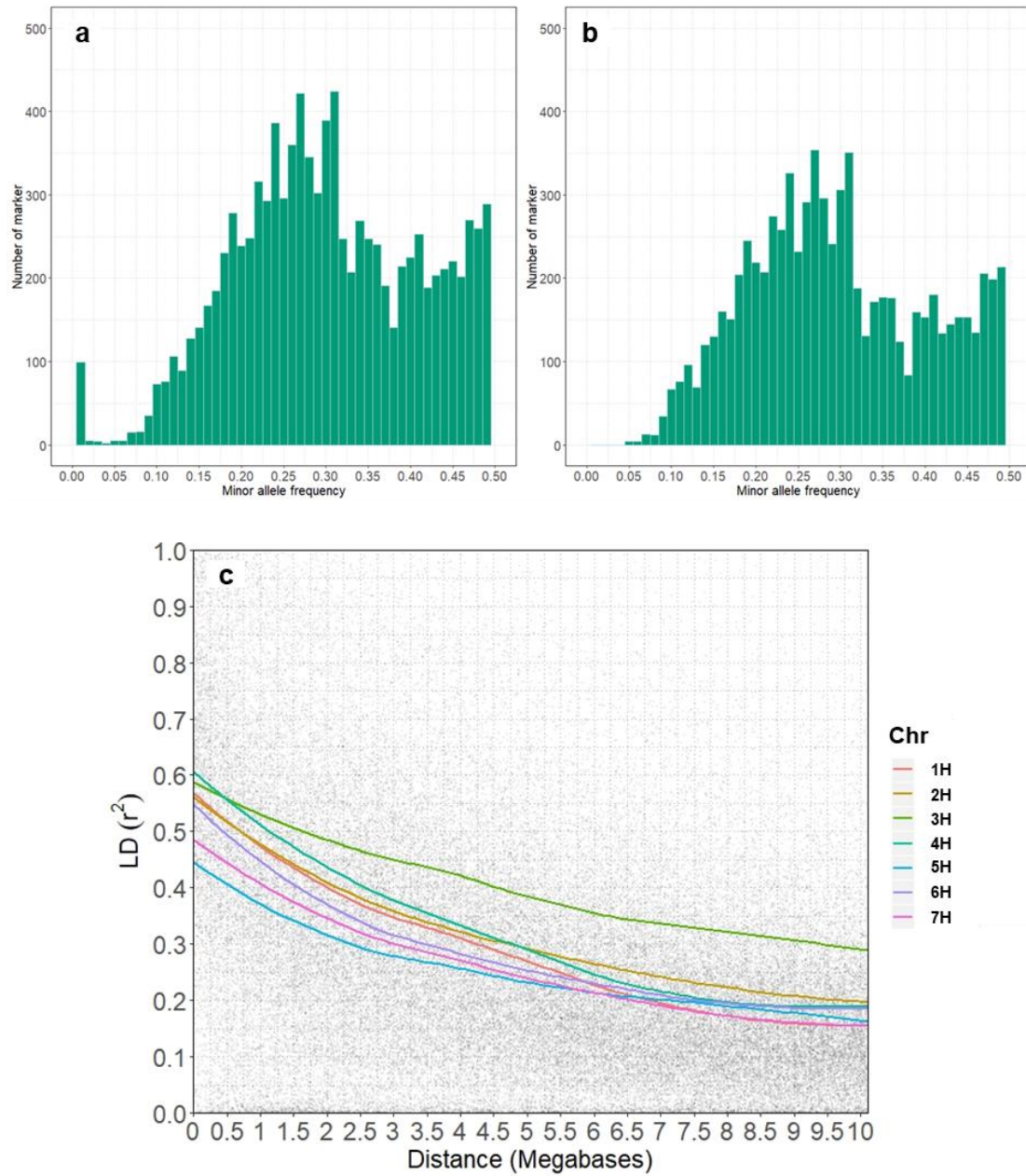


Fig. S1 Minor allele frequency distribution of the (a) original marker set, and (b) the marker set after filtering with minor allele frequency threshold of 0.05, missingness threshold of 0.2 using PLINK 1.9 and imputed using BEAGLE 5.0; (c) linkage disequilibrium (LD, r^2) of markers. The coloured lines depict second-degree LOESS curves for each chromosome

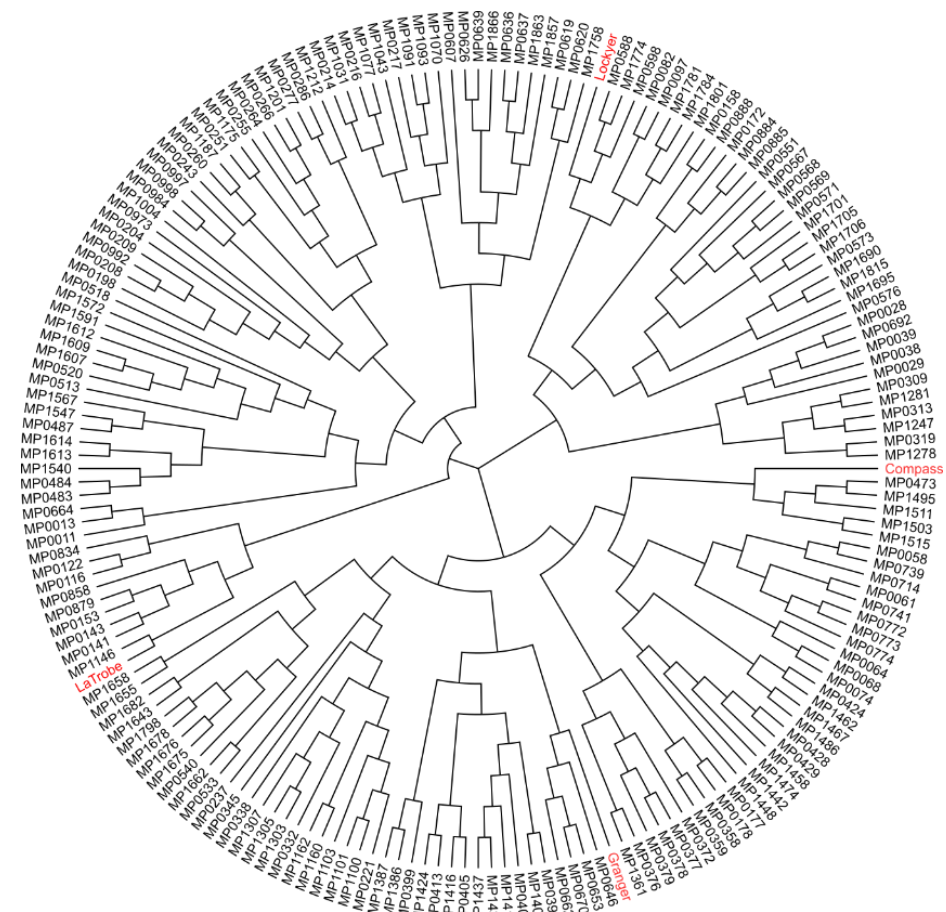


Fig. S2 Phylogenetic tree constructed from 184 recombinant lines and four parental cultivars

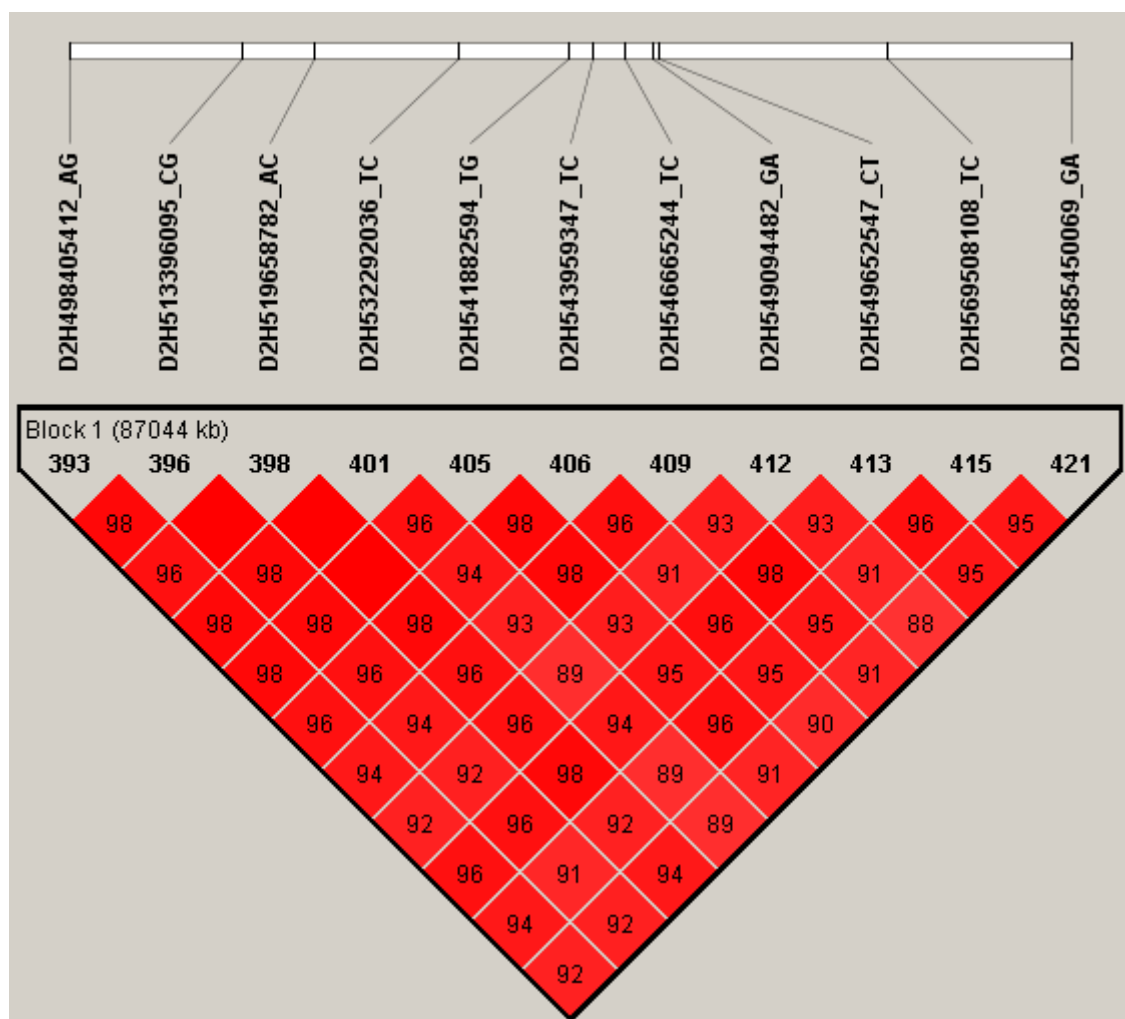


Fig. S3 Linkage analysis result of 11 genetic markers associated with flowering time spanning a 100 Mb region on chromosome 2H