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Supplementary Material

Supplementary Table 1.

Allelic characterization of varieties for vernalization (*Vrn*) and photoperiod (*Ppd*) loci. The photoperiod and vernalization alleles were combined to construct haplotypes in which A1 (*Ppd-A1a+Ppd-D1a*), A2 (*Ppd-A1a+Ppd-D1b*), A3 (*Ppd-A1b+Ppd-D1a*), and A4 (*Ppd-A1b+Ppd-D1b*) in which the a and b alleles represent photoperiod insensitivity and sensitivity, respectively. While B1 (*Vrn-D1*) and B2 (*vrn-D1*) represent the spring and winter vernalization alleles, respectively.

Genotype / Accession	**MLGs**	***Ppd-A1***	***Ppd-B1***	***Ppd-D1***	***Vrn-D1***
Gaoyou 503	A1B1	*Ppd-A1a*	*Ppd-B1b*	*Ppd-D1a*	*Vrn-D1-spring*
Jingdong 1	A1B2	*Ppd-A1a*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Jinmai 8	A1B2	*Ppd-A1a*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Shixin 828	A1B2	*Ppd-A1a*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Taiyuan 136	A1B2	*Ppd-A1a*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Nongda 311	A2B2	*Ppd-A1a*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Huabei 187	A2B2	*Ppd-A1a*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Yanda 1817	A2B2	*Ppd-A1a*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Hongpidongmai	A2B2	*Ppd-A1a*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Hengguan 35	A3B1	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*Vrn-D1-spring*
Yumai 35	A3B1	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*Vrn-D1-spring*
Shanmai 150	A3B1	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*Vrn-D1-spring*
Gaocheng 8901	A3B1	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*Vrn-D1-spring*
Xinong 509	A3B1	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*Vrn-D1-spring*
Shiyou 17	A3B1	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*Vrn-D1-spring*
Jimai 738	A3B1	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*Vrn-D1-spring*
CA9722	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Dongfanghong 3	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Zhongmai 175	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Fengkang 2	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Fengkang 7	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Fengkang 8	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Jing 411	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Jing 9428	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Jingdong 12	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Jingdong 17	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Jingdong 22	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Jingdong 6	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Jingdong 8	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Jingshuang 10	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Jingshuang 12	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Jingshuang 16	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*

Jingshuang 9	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Lanhuamai	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Nongda 139	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Nongda 146	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Nongda 211	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Nongda 212	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Nongda 3432	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Beijing 10	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Beijing 15	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Beijing 8	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Yuandong 822	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Lvhan 328	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Zhoumai 18	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Jimai 22	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Yannong 19	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Bima 1	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Hongliang 4	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Laomai	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Liangxing 99	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Lunxuan 518	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Lunxuan 987	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Han 6172	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Changfeng 1	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Changzhi 6406	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Shanxibaimai	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Zhongmai 998	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Zhongyou 9507	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
PH82-2-2	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Yumai 49	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Yumai 66	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Jinan 17	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Kenong 2009	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Gaoyou 5766	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Gaoyou 5218	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Shiluan 02-1	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Lunxuan 061	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Yuanfeng 175	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Xinong 529	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Henong 58-3	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Shiyou 20	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Shi 4366	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Jimai U80	A3B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1a*	*vrn-D1*
Dabaimang	A4B1	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*Vrn-D1-spring*
Dahongmang	A4B1	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*Vrn-D1-spring*

Xiaokouhong	A4B1	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*Vrn-D1-spring*
Daimanghongmai	A4B1	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*Vrn-D1-spring*
Niuzhijia	A4B1	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*Vrn-D1-spring*
Baiqimai	A4B1	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*Vrn-D1-spring*
Zhongyou 206	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Jiahongmai	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Nongda 183	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Nongda 36	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Dingxian 72	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Xiaomaimang	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Yan'an 11	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Zaoyangmai	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Youmangbai 4	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Youmangbaifu J	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Youmangbaifu L	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*Vrn-D1*
Zhuoludongmai	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Baiqiumai	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Panshiwumang	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Honglaomai	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Hongjinmai	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Hongmai	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Mingxian 169	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Mahuaban	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*
Qi 79-2060	A4B2	*Ppd-A1b*	*Ppd-B1b*	*Ppd-D1b*	*vrn-D1*

Supplementary Table 2. The *Vrn* sensitivity (R_v), *Ppd* sensitivity (R_P) and target thermal time from floral initial to flowering ($TT_{FI, FL}$) parameter values of MLG-based model for different wheat varieties (units are given within brackets). Four gene-specific parameters including k_v (slopes of varieties for *Vrn*), k_p (slopes of varieties for *Ppd*), b_v

(intercepts of the varieties indicating the unknown effects of the *Vrn* genes), and b_p (the intercepts of the varieties indicating the unknown effects of the *Ppd* genes) were 0.3, 0.2, 0.9，and 0, respectively.

Variety	MLGs	Allelic combinations of *Vrn* and *Ppd* genes	MLG-based model		
			$TT_{FI, FL}$ (°C days)	R_v (-)	R_p (-)
Gaoyou 503	A1B1	*Ppd-A1a+Ppd-D1a+Vrn-D1-spring*	910	0.7	0.7
Jingdong 1	A1B2	*Ppd-A1a+Ppd-D1a+vrn-D1*	790	0.7	1.8
Jinmai 8	A1B2	*Ppd-A1a+Ppd-D1a+vrn-D1*	820	0.7	1.8
Shixin 828	A1B2	*Ppd-A1a+Ppd-D1a+vrn-D1*	800	0.7	1.8
Taiyuan 136	A1B2	*Ppd-A1a+Ppd-D1a+vrn-D1*	880	0.7	1
Nongda 311	A2B2	*Ppd-A1a+Ppd-D1b+vrn-D1*	600	2.7	2.2
Huabei 187	A2B2	*Ppd-A1a+Ppd-D1b+vrn-D1*	570	2.7	2.2
Yanda 1817	A2B2	*Ppd-A1a+Ppd-D1b+vrn-D1*	690	2.7	2.2
Hongpidongmai	A2B2	*Ppd-A1a+Ppd-D1b+vrn-D1*	810	2.7	2.2
Hengguan 35	A3B1	*Ppd-A1b+Ppd-D1a+Vrn-D1-spring*	830	0.7	0.7
Yumai 35	A3B1	*Ppd-A1b+Ppd-D1a+Vrn-D1-spring*	890	0.7	0.7
Shanmai 150	A3B1	*Ppd-A1b+Ppd-D1a+Vrn-D1-spring*	870	0.7	0.7
Gaocheng 8901	A3B1	*Ppd-A1b+Ppd-D1a+Vrn-D1-spring*	890	0.7	0.7
Xinong 509	A3B1	*Ppd-A1b+Ppd-D1a+Vrn-D1-spring*	890	0.7	0.7
Shiyou 17	A3B1	*Ppd-A1b+Ppd-D1a+Vrn-D1-spring*	890	0.7	0.7
Jimai 738	A3B1	*Ppd-A1b+Ppd-D1a+Vrn-D1-spring*	890	0.7	0.7
CA9722	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	740	0.7	1.8
Dongfanghong 3	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	630	2.7	2.2
Zhongmai 175	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	780	0.7	1.8
Fengkang 2	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	840	0.7	1.8
Fengkang 7	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	770	0.7	1.8
Fengkang 8	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	780	0.7	1.8
Jing 411	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	780	0.7	1.8
Jing 9428	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	830	0.7	1.8
Jingdong 12	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	790	0.7	1.8
Jingdong 17	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	730	0.7	1.8
Jingdong 22	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	790	0.7	1.8
Jingdong 6	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	740	0.7	1.8
Jingdong 8	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	780	0.7	1.8
Jingshuang 10	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	740	0.7	1.8
Jingshuang 12	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	760	0.7	1.8
Jingshuang 16	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	790	0.7	1.8
Jingshuang 9	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	760	0.7	1.8
Lanhuamai	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	810	0.7	1.8
Nongda 139	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	820	0.7	1.8
Nongda 146	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	790	0.7	1.8
Nongda 211	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	780	0.7	1.8
Nongda 212	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	800	0.7	1.8
Nongda 3432	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	810	0.7	1.8

Beijing 10	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	870	0.7	1.8
Beijing 15	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	800	0.7	1.8
Beijing 8	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	780	0.7	1.8
Yuandong 822	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	810	0.7	1.8
Lvhan 328	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	780	0.7	1.8
Zhoumai 18	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	870	0.7	1.8
Jimai 22	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	810	0.7	1.8
Yannong 19	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	840	0.7	1.8
Bima 1	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	850	0.7	1.8
Hongliang 4	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	830	0.7	1.8
Laomai	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	860	0.7	1.8
Liangxing 99	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	830	0.7	1.8
Lunxuan 518	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	830	0.7	1.8
Lunxuan 987	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	780	0.7	1.8
Han 6172	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	800	0.7	1.8
Changfeng 1	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	760	0.7	1.8
Changzhi 6406	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	860	0.7	1.8
Shanxibaimai	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	810	0.7	1.8
Zhongmai 998	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	810	0.7	1.8
Zhongyou 9507	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	840	0.7	1.8
PH82-2-2	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	800	0.7	1.8
Yumai 49	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	800	0.7	1.8
Yumai 66	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	760	0.7	1.8
Jinan 17	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	810	0.7	1.8
Kenong 2009	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	830	0.7	1.8
Gaoyou 5766	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	830	0.7	1.8
Gaoyou 5218	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	830	0.7	1.8
Shiluan 02-1	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	830	0.7	1.8
Lunxuan 061	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	800	0.7	1.8
Yuanfeng 175	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	870	0.7	1.8
Xinong 529	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	820	0.7	1.8
Henong 58-3	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	810	0.7	1.8
Shiyou 20	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	810	0.7	1.8
Shi 4366	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	870	0.7	1.8
Jimai U80	A3B2	*Ppd-A1b+Ppd-D1a+vrn-D1*	830	0.7	1.8
Zhongyou 206	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	820	0.7	1.8
Jiahongmai	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	650	2.7	2.2
Nongda 183	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	570	2.7	2.2
Nongda 36	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	590	2.7	2.2
Dingxian 72	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	630	2.7	2.2
Xiaomaimang	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	630	2.7	2.2
Yan'an 11	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	700	2.7	2.2
Zaoyangmai	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	590	2.7	2.2
Youmangbai 4	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	540	2.7	2.2

Youmangbaifu J	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	760	2.7	2.2
Zhuoludongmai	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	610	2.7	2.2
Baiqiumai	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	730	2.7	2.2
Panshiwumang	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	800	2.7	2.2
Honglaomai	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	840	2.7	2.2
Hongjinmai	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	630	2.7	2.2
Hongmai	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	560	2.7	2.2
Mingxian 169	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	650	2.7	2.2
Mahuaban	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	760	2.7	2.2
Qi 79-2060	A4B2	*Ppd-A1b+Ppd-D1b+vrn-D1*	590	2.7	2.2

Supplementary Table 3. The broad sense heritability (H^2) of the wheat-flowering-date of different MLGs. The broad sense heritability was estimated as the ratio of the sum of the additive and epistatic (additive-by-additive) variance to the total phenotypic variance. The field-observed flowering date of wheat for calibrating and evaluating the

MLG-based model (2016-2019 growing season) at the Beijing Shunyi Experimental Base (40°15′N, 116°55′E) was used to calculate broad sense heritability (H^2).

MLGs	**Heritability** (H^2)
A1B1	NA
A1B2	0.625
A2B2	0.984
A3B1	0.930
A3B2	0.982
A4B1	0.948
A4B2	0.983