Supplementary Table S1

Conversion relationships of MG and RMG (For maturity group earlier than MG 0.0)

MG	RMG	MG	RMG	MG	RMG
0.0	0.0	000.9	-1.1	0000.8	-2.2
00.9	-0.1	000.8	-1.2	0000.7	-2.3
00.8	-0.2	000.7	-1.3	0000.6	-2.4
00.7	-0.3	000.6	-1.4	0000.5	-2.5
00.6	-0.4	000.5	-1.5	0000.4	-2.6
00.5	-0.5	000.4	-1.6	0000.3	-2.7
00.4	-0.6	000.3	-1.7	0000.2	-2.8
00.3	-0.7	000.2	-1.8	0000.1	-2.9
00.2	-0.8	000.1	-1.9	0000.0	-3.0
00.1	-0.9	000.0	-2.0		
00.0	-1.0	0000.9	-2.1		

Supplementary Table S2

The region, ecotype, RMG, MG, and ≥ 10℃ active accumulated temperature of 395 soybean varieties

Cultivar	Maturity group	Relative maturity group	≥ 10℃ AAT （℃）	Cultivar	Maturity group	Relative maturity group	≥ 10℃ AAT （℃）	Data sources
Beijiang 1	00	-0.4	1900	Heinong 66	Ⅰ	1.6	2450	
Chenhuan 1	0	0.4	2200	Heinong 67	Ⅰ	1.3	2325	
Dongnong 40	00	-0.8	1900	Heinong 68	0	0.9	2350	
Dongnong 41	000	-1.6	1700	Heinong 69	Ⅱ	2.6	2600	
Dongnong 52	Ⅰ	1.8	2500	Huajiang 1	00	-0.4	1860	
Dongnong 54	Ⅰ	1.5	2600	Huajiang 2	00	-0.3	1950	Database of Ministry of Agriculture and Rural Affairs, China
Dongnong 55	Ⅰ	1.7	2580	Huajiang 4	0	0.2	2050	
Dongnong 61	Ⅰ	1.9	2600	Jiyu 52	Ⅱ	2.2	2600	
Dongsheng 1	Ⅰ	1.1	2360	Jiyu 54	Ⅱ	2.8	2500	
Dongsheng 4	0	0.6	2400	Jiyu 67	0	0.9	2400	
Dongsheng 5	0	0.3	2250	Ji 1005	Ⅲ	3	2900	

Dongsheng 7	0	0.7	2250	Jiangmodou 1	0	0.1	2100
Dongsheng 8	0	0.8	2250	Jiufeng 10	0	0	2200
Fengdou 2	0	0.9	2400	Jiufeng 7	00	-0.1	2200
Fengshou 23	00	-0.5	1709	Kangxian 2	I	1.2	2530
Fengshou 27	0	0.2	2300	Kangxian 4	0	0.7	2300
Hefeng 25	0	0.5	2413	Kenfeng 16	I	1.6	2450
Hefeng 35	0	0.8	2338	Kenfeng 17	I	1.5	2350
Hefeng 37	00	-0.8	1886	Kenfeng 22	0	0.6	2250
Hefeng 41	0	0	2427	Kennong 18	0	0.7	2300
Hefeng 51	0	0.8	2200	Kennong 4	I	1.8	2400
Hefeng 55	I	1.2	2366	Longhuang 1	I	1.2	2340
Heidou 12	00	-0.5	1800	Mengdou 16	0	0	2100
Heihe 13	00	-0.8	1950	Mengdou 17	0	0.3	2200
Heihe 14	000	-1.2	1700	Mengdou 19	00	-0.4	1800

Database of Ministry of Agriculture and Rural Affairs, China

Heihe 18	0	0	2150	Mengdou 21	0	0.4	2100
Heihe 19	0	0.2	2170	Mengdou 24	III	3.8	2800
Heihe 27	0	0	2100	Mengdou 25	II	2.7	2800
Heihe 28	00	-0.7	1700	Mengdou 26	0	0.4	2250
Heihe 31	00	-0.3	2050	Mengdou 28	0	0.7	2300
Heihe 33	00	-0.6	1900	Mengdou 30	0	0.4	2400
Heihe 35	000	-1.2	1780	Mengdou 31	00	-0.9	1700
Heihe 37	00	-0.4	1850	Mengdou 32	00	-0.6	1900
Heihe 38	0	0.4	2150	Mengdou 33	0	0.4	2300
Heihe 39	00	-0.2	2100	Mengdou 37	0	0.1	1900
Heihe 41	00	-0.6	1720	Mengdou 7	00	-0.6	1900
Heihe 42	0	0	2060	Nenfeng 15	0	0.6	2400
Heihe 43	0	0	2150	Nenfeng 16	I	1	2400
Heihe 44	000	-1	1750	Nenfeng 17	0	0.6	2500

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Heihe 45	00	-0.1	2050	Nenfeng 18	0	0.9	2480
Heihe 49	000	-1.1	1750	Nenfeng 19	Ⅰ	1.2	2500
Heihe 50	00	-0.3	2100	Nenfeng 20	Ⅰ	1.7	2500
Heihe 51	0	0.3	2050	Qinong 1	0	0.4	2550
Heihe 52	0	0.2	2150	Qinong 2	Ⅰ	1.4	2550
Heihe 53	00	-0.1	2100	Sinong 2	Ⅱ	2.7	2700
Heihe 9	00	-0.1	2000	Suinong 10	Ⅰ	1.3	2300
Heinong 35	Ⅰ	1.1	2353	Suinong 22	Ⅰ	1.2	2400
Heinong 37	Ⅰ	1.3	2600	Suinong 26	Ⅰ	1.4	2400
Heinong 40	Ⅰ	1.9	2680	Suinong 27	Ⅰ	1.2	2300
Heinong 41	Ⅱ	2.5	2628	Suinong 29	Ⅰ	1.2	2400
Heinong 42	Ⅰ	1.8	2600	Suinong 32	Ⅰ	1.2	2430
Heinong 43	Ⅰ	1.8	2450	Suinong 33	0	0.8	2400
Heinong 44	Ⅰ	1.3	2600	Suinong 34	Ⅰ	1.2	2450

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Heinong 45	Ⅰ	1	2500	Suinong 35	Ⅰ	1.3	2450	
Heinong 49	Ⅰ	1.9	2350	Suinong 36	Ⅰ	1.3	2350	
Heinong 50	Ⅰ	1.2	2300	Suinong 37	0	0.8	2250	
Heinong 52	Ⅱ	2.6	2550	Suinong 38	Ⅰ	1.1	2250	
Heinong 53	Ⅰ	1.7	2600	Suinong 39	Ⅰ	1	2250	
Heinong 55	Ⅰ	1.4	2800	Suinong 41	Ⅰ	1.2	2400	
Heinong 56	Ⅰ	1.2	2380	Suizhongzuo 40	Ⅰ	1.2	2400	Database of Ministry of Agriculture and Rural Affairs, China
Heinong 58	Ⅱ	2.3	2400	Xingdou 4	0	0.9	2440	
Heinong 59	Ⅰ	1.2	2400	Xingdou 5	Ⅰ	1.2	2470	
Heinong 61	Ⅱ	2.1	2600	Yannong 10	Ⅰ	1.4	2300	
Heinong 62	Ⅱ	2.4	2600	Changnong 13	Ⅰ	1.6	2650	
Heinong 63	Ⅰ	1.7	2600	Changnong 14	Ⅰ	1.5	2450	
Heinong 64	Ⅰ	1.5	2400	Changnong 15	Ⅱ	2	2650	
Heinong 65	Ⅰ	1	2350	Zhongzuoyin 1	0	0.5	2800	

Beidou 14	0	0.4	2200	Dongnong 44	00	-0.5	1900	《Soybean Variety Records 1993-2004》
Beidou 16	00	-0.8	1870	Dongnong 47	0	0.9	2400	
Beidou 24	00	-0.6	1800	Dongnong 48	0	0.8	2300	《Soybean Variety Records 2005-2014》
Beidou 40	0	0.9	2350	Dongnong 49	00	-0.4	2100	
Beidou 5	0	0.4	2250	Kaiyu 11	II	2.7	2800	
Beifeng 9	0	0.7	2300	Kangxian 3	I	1.6	2550	
Chidou 1	II	2.6	2700	Kenjiandou 25	00	-0.1	2230	
Dongda 1	00	-0.7	1880	Kenjiandou 27	0	0.4	2200	
Dongda 2	000	-1.2	1800	Kenjiandou 28	0	0.5	2260	
Dengke 1	0	0.4	2200	Dengke 4	0	0.4	2250	《Soybean Variety Records 2005-2014》
Dengke 2	000	-1.1	1700	Dengke 5	0	0.6	2100	
Dengke 3	0	0	2100					
Beidou 10	I	1	2150	Jiyu 65	III	3	2809	
Beidou 19	0	0.4	2150	Jiyu 66	I	1.7	2629	Provided by breeding institutes

Beidou 20	0	0.1	2200	Jiyu 68	II	2.7	2760
Beidou 21	0	0.7	2220	Jiyu 69	I	1.5	2597
Beidou 28	I	1.2	2250	Jiyu 70	II	2.9	2825
Beidou 2	0	0.4	2150	Jiyu 71	II	2.6	2746
Beidou 37	0	0.4	2250	Jiyu 72	II	2.5	2837
Beidou 8	0	0.6	2150	Jiyu 73	II	2	2662
Beifeng 2	00	-0.1	2000	Jiyu 74	III	3.2	2866
Dongdou 16	I	1.9	2700	Jiyu 75	II	2.9	2805
Dongdou 1	II	2.9	3100	Jiyu 76	II	2.2	2670
Dongdou 29	II	2.7	3000	Jiyu 77	II	2.9	2783
Dongdou 50	I	1.8	2800	Jiyu 79	I	1.3	2532
Dongnong 36	000	-1.3	1700	Jiyu 80	I	1.8	2628
Dongnong 4	0	0	1950	Jiyu 81	III	3	2804
Dongsheng 3	I	1.5	2330	Jiyu 82	III	3.1	2830

Provided by breeding institutes

Dongsheng 6	Ⅰ	1.5	2350	Jiyu 83	Ⅰ	1	2403	
Dongsheng 9	Ⅰ	1.1	2330	Jiyu 85	Ⅰ	1.9	2612	
Fengshou 10	0	0.4	2320	Jiyu 86	Ⅱ	2.5	2772	
Fengshou 11	0	0.3	2050	Jiyu 87	Ⅰ	1.7	2576	
Fengshou 12	0	0.6	2350	Jiyu 88	Ⅱ	2.3	2735	
Fengshou 15	0	0.1	2250	Jiyu 89	Ⅱ	2.3	2681	
Fengshou 24	0	0	2250	Jiyu 90	Ⅱ	2.8	2820	
Fengshou 26	0	0.1	2250	Jiyu 91	Ⅱ	2.6	2771	Provided by breeding institutes
Fu97-16	Ⅲ	3	2800	Jiyu 92	Ⅱ	2.5	2723	
Fudou 17	Ⅰ	1.9	2800	Jiyu 93	Ⅱ	2.7	2728	
Fudou 18	Ⅰ	1.9	2800	Jiyu 94	Ⅱ	2.3	2750	
Fudou 19	Ⅰ	1.9	2750	Jiyu 95	Ⅱ	2.7	2824	
Fudou 20	Ⅱ	2.3	2800	Jiyu 96	Ⅱ	2.9	2794	
Fudou 21	Ⅱ	2.6	2800	Jiyu 97	Ⅱ	2	2660	

Fudou 22	III	3.1	2800	Jiyu 99	II	2.5	2770
Fudou 23	II	2.7	2800	Kaichuang 16	III	3.2	2750
Hefeng 24	0	0.4	2300	Kaiyu 13	III	3.2	2800
Hefeng 40	0	0.2	2250	Kangxian 10	II	2	2550
Hefeng 50	I	1	2350	Kangxian 11	I	1.4	2550
Hefeng 53	0	0.7	2400	Kangxian 12	II	2.3	2550
Heihe 36	0	0.6	2200	Kangxian 13	I	1.3	2550
Heihe 3	0	0	2150	Kangxian 6	I	1.4	2500
Heihe 46	0	0	2160	Kangxian 8	I	1.5	2500
Heihe 48	0	0.3	2200	Kangxian 9	I	1.7	2550
Heihe 54	0	0.3	2100	Keshan 1	0	0.5	2250
Heihe 7	00	-0.2	2200	Kenfeng 18	I	1.8	2400
Heihe 8	00	-0.4	2050	Kenfeng 31	I	1.7	2380
Heinong 16	I	1	2450	Kennong 25	I	1.9	2350

Provided by breeding institutes

Heinong 26	Ⅰ	1.4	2450	Liaodou 15	Ⅲ	3.4	3050	
Heinong 27	Ⅰ	1.5	2350	Liaodou 17	Ⅲ	3.7	3150	
Heinong 29	Ⅰ	1.5	2462	Liaodou 19	Ⅲ	3.7	3100	
Heinong 30	Ⅰ	1.3	2450	Liaodou 20	Ⅲ	3.6	3100	
Heinong 31	Ⅰ	1	2450	Liaodou 21	Ⅱ	2.6	2900	
Heinong 32	Ⅰ	1.5	2550	Liaodou 31	Ⅲ	3.6	3150	
Heinong 33	Ⅰ	1.5	2499	Liaodou 32	Ⅰ	1.8	2750	
Heinong 34	Ⅰ	1.4	2450	Liaodou 33	Ⅲ	3.5	3150	Provided by breeding institutes
Heinong 48	Ⅰ	1.5	2450	Liaodou 34	Ⅲ	3.8	2900	
Heinong 51	Ⅱ	2.1	2600	Liaodou 35	Ⅲ	3.3	3150	
Heinong 60	Ⅰ	1.1	2450	Liaodou 36	Ⅲ	3.5	3200	
Hongfeng 2	0	0.2	2150	Liaodou 4	Ⅱ	2.8	2950	
Huajiang 3	0	0.2	2200	Mengdou 12	0	0.3	2250	
Jihei 1	Ⅰ	1.4	2546	Mengdou 13	0	0.8	2300	

Jihei 2	II	2.8	2780	Mengdou 14	0	0.6	2260
Jihei 3	II	2.5	2747	Mengdou 15	0	0.4	2250
Jihei 4	III	3.2	2884	Mengdou 5	0	0.3	2250
Jikedou 1	I	1.6	2607	Mengdou 6	0	0.7	2180
Jikedou 2	II	2.9	2809	Neidou 3	0	0	2200
Jikedou 3	I	1.8	2601	Neidou 4	00	-0.6	1950
Jikedou 5	II	2.1	2687	Suinong 31	I	1.2	2400
Jikedou 6	II	2	2641	Suinong 8	I	1.1	2400
Jikedou 7	II	2.8	2824	Tiedou 36	III	3.7	3000
Jikedou 8	I	1.8	2589	Tiedou 37	III	3.8	3000
Jikedou 9	II	2.2	2725	Tiedou 38	III	3.7	3000
Jilinxiaoli 6	III	3.2	2836	Tiedou 39	III	3.7	3000
Jilinxiaoli 7	II	2.2	2673	Tiedou 40	III	3.7	3000
Jilinxiaoli 8	II	2.2	2664	Tiedou 42	III	3.7	3000

Provided by breeding institutes

Jimidou 2	II	2.1	2643	Tiedou 43	II	2.5	2800	
Jinong 18	II	2.2	2643	Tiedou 44	III	3.1	3000	
Jiqing 3	III	3.2	2924	Tiedou 45	III	3.6	3000	
Jiyu 100	I	1.7	2582	Tiedou 46	III	3	3000	
Jiyu 101	II	2.3	2694	Tiedou 47	III	3	3000	
Jiyu 102	II	2.2	2671	Tiedou 48	III	3.8	3000	
Jiyu 103	II	2.5	2736	Tiedou 49	IV	4	3200	
Jiyu 104	II	2.3	2715	Tiedou 50	III	3.5	3000	Provided by breeding institutes
Jiyu 105	I	1.8	2590	Tiedou 51	III	3.5	3000	
Jiyu 201	I	1.6	2616	Tiedou 52	III	3.4	3000	
Jiyu 202	I	1.5	2545	Tiedou 53	III	3.8	3200	
Jiyu 203	II	2.3	2696	Tiedou 54	III	3.4	3000	
Jiyu 301	II	2.5	2737	Tiedou 55	III	3.4	3000	
Jiyu 302	II	2	2624	Tiedou 56	III	3.7	3000	

Jiyu 32	II	2.4	2701	Tiedou 57	III	3.6	3000	
Jiyu 34	II	2.9	2792	Tiedou 58	IV	4	3000	
Jiyu 35	I	1.6	2606	Tiedou 59	III	3.9	3000	
Jiyu 36	III	3	2833	Tiedou 60	III	3.4	3000	
Jiyu 38	II	2.9	2824	Tiedou 61	III	3.8	3200	
Jiyu 39	II	2.3	2731	Tiedou 63	III	3.8	3000	
Jiyu 401	II	2.1	2673	Tiefeng 19	II	2	3000	Provided by breeding institutes
Jiyu 402	II	2.4	2728	Tiefeng 29	IV	4	3000	
Jiyu 403	II	2.7	2762	Tiefeng 30	III	3.6	3000	
Jiyu 404	II	2.6	2750	Tiefeng 31	III	3.5	3200	
Jiyu 405	II	2.7	2729	Tiefeng 33	III	3.4	3000	
Jiyu 406	II	2.3	2715	Tiefeng 34	III	3.6	3200	
Jiyu 43	I	1.4	2538	Xinfeng 1	II	2	2800	
Jiyu 45	II	2.6	2751	Xingdou 3	I	1.3	2450	

Jiyu 46	Ⅰ	1.7	2591	Xingkangxian 1	Ⅰ	1.2	2450	
Jiyu 47	Ⅰ	1.7	2644	Changnong 10	Ⅰ	1.9	2600	
Jiyu 49	Ⅰ	1.4	2535	Changnong 11	Ⅱ	2.8	2750	
Jiyu 50	Ⅲ	3	2791	Changnong 12	Ⅰ	1.8	2450	
Jiyu 501	Ⅱ	2.8	2775	Changnong 16	Ⅱ	2.2	2600	
Jiyu 502	Ⅲ	3.1	2828	Changnong 17	Ⅱ	2.2	2450	
Jiyu 503	Ⅱ	2.3	2707	Changnong 18	Ⅱ	2.6	2750	
Jiyu 504	Ⅱ	2.9	2803	Changnong 19	Ⅱ	2	2400	Provided by breeding institutes
Jiyu 505	Ⅲ	3	2827	Changnong 20	Ⅰ	1.6	2350	
Jiyu 55	Ⅱ	2	2638	Changnong 21	Ⅰ	1.9	2450	
Jiyu 56	Ⅱ	2.9	2777	Changnong 22	Ⅱ	2.7	2750	
Jiyu 57	Ⅱ	2.4	2770	Changnong 23	Ⅱ	2.6	2600	
Jiyu 58	Ⅰ	1.4	2480	Changnong 24	Ⅰ	1.4	2300	
Jiyu 59	Ⅱ	2.5	2706	Changnong 25	Ⅱ	2.6	2750	

Jiyu 60	Ⅲ	3	2849	Changnong 26	Ⅰ	1.6	2450	Provided by breeding institutes
Jiyu 61	Ⅱ	2.5	2766	Changnong 27	Ⅱ	2.4	2600	
Jiyu 62	Ⅱ	2.6	2748	Changnong 28	Ⅱ	2.9	2750	
Jiyu 63	Ⅱ	2.1	2819	Changnong 8	Ⅱ	2.8	2650	
Jiyu 64	Ⅰ	1.6	2590	Changnong 9	Ⅱ	2.6	2700	

Supplementary Table S3

The 30-year average of CHU (Crop Heat Unit), ≥ 10℃ active accumulated temperature, longitude, latitude of 95 weather stations in this study

Weather station number	CHU	≥ 10℃ active accumulated temperature	longitude	latitude
Mohe	2445	1813	122.52	52.97
Tahe	2603	1957	124.72	52.35
Huzhong	2490	1761	123.57	52.03
Xinlin	2534	1867	124.35	51.70
Huma	3070	2392	126.65	51.72
Jiagedaqi	2921	2200	124.12	50.40
Aihui	3222	2533	127.45	50.26
Nenjiang	3274	2591	125.23	49.17
Sunhao	3101	2430	127.35	49.43
Beian	3319	2604	126.52	48.28
Keshan	3522	2787	125.87	48.05
Longjiang	3874	3073	123.18	47.33
Fuyu	3711	2943	124.48	47.80
Qiqihar	3965	3136	123.92	47.38
Hailun	3532	2783	126.97	47.43
Mingshui	3661	2900	125.90	47.17
Yichun	3256	2487	128.92	47.73
Hegang	3493	2748	130.27	47.34
Fujin	3624	2852	131.98	47.23
Tailai	4059	3224	123.42	46.40
Beilin	3791	2985	126.97	46.62
Anda	3923	3112	125.31	46.40
Tieli	3526	2753	128.02	46.98
Jiamusi	3715	2962	130.28	46.83
Yilan	3710	2895	129.59	46.30
Baoqing	3754	2988	132.18	46.32
Zhaozhou	4018	3181	125.25	45.70
Harbin	4032	3205	126.76	45.75
Tonghe	3666	2836	128.73	45.97
Shangzhi	3742	2875	127.97	45.22
Boli	3792	3028	130.60	45.75
Jixi	3720	2908	130.93	45.30
Hulin	3666	2838	132.97	45.77
Mudanjiang	3886	3004	129.60	44.57

Suifenhe	3183	2455	131.17	44.38
Baicheng	4114	3283	122.84	45.63
Daan	4123	3267	124.27	45.50
Qianan	4254	3367	124.02	45.00
Qianguo	4252	3345	124.87	45.08
Tongyu	4250	3392	123.07	44.78
Changling	4267	3366	123.97	44.25
Fuyu	4002	3146	126.00	44.97
Nongan	4091	3226	125.15	44.38
Shuangliao	4347	3412	123.53	43.50
Siping	4427	3500	124.33	43.17
Changchun	4264	3354	125.22	43.90
Shuangyang	4140	3256	125.63	43.55
Chimney Hill	4030	3133	126.02	43.30
Yongji	4029	3157	126.52	43.70
Jilin peri urban	4076	3208	126.47	43.95
Jiaohe	3792	2889	127.33	43.70
Dunhua	3491	2664	128.20	43.37
Luozigou	3470	2585	130.25	43.70
Wangqing	3718	2749	129.78	43.30
Liaoyuan	4162	3253	125.08	42.09
Panshi	3946	3056	126.05	42.97
Meihekou	4098	3171	125.62	42.53
Huadian	3998	3035	126.75	42.98
Jingyu	3546	2690	126.82	42.35
Donggang	3346	2598	127.56	42.10
Erdao	3376	2540	128.25	42.53
Helong	3696	2814	129.00	42.53
Yanji	3918	2958	129.50	42.87
Tonghua	4112	3101	125.90	41.68
Linjiang	4069	3012	126.92	41.80
Jian	4439	3371	126.15	41.10
Changbai	3287	2384	128.18	41.42
Zhangwu	4611	3632	122.53	42.42
Kaiyuan	4532	3572	124.05	42.53
Qingyuan	4234	3214	124.92	42.10
Jianping	4700	3736	119.70	41.38
Xinmin	4763	3727	123.78	41.32
Benxi	4640	3628	123.78	41.32
Fushun	4413	3417	124.08	41.92
Caohekou	4154	3115	123.90	40.88
Youyan	4539	3466	123.28	40.28

Kuandian	4297	3303	124.78	40.72
Erguna	2863	2233	120.18	50.25
Tulihe	2293	1646	121.68	50.48
Manzhouli	2912	2313	117.43	49.57
Hailar	3013	2369	119.75	49.22
Xiaoergou	3200	2430	123.72	49.20
Xin Barag Right Banner	3330	2647	116.82	48.67
Xin Barag Left Banner	3244	2564	118.27	48.22
ZhaLanTun	3598	2783	122.73	48.00
Arxan	2401	1793	119.92	47.17
Suolun	3392	2591	121.22	46.60
Jarud Banner	4386	3506	120.90	44.57
Balinzuoqi	4014	3216	119.40	43.98
Linxi	3667	2937	118.07	43.60
Kailu	4401	3529	121.28	43.60
Tongliao	4455	3556	122.27	43.60
Wengniute Banner	4091	3286	119.02	42.93
Chifeng	4362	3459	118.93	42.27
Baoguotu	4317	3450	120.70	42.33