



Supplementary Material

Correlation analysis between heterosis and genetic distance evaluated by 15K SNP array in hybrid wheat

Supplementary Tables 1. The wheat germplasm and sources.

Genotype	Name	Source	Genotype	Name	Source
S001	K456S	Yunnan	R151	2019Y ₂ -288	Yunnan
S002	K43S	Yunnan	R152	2019Y ₂ -293	Yunnan
S003	K64S	Yunnan	R153	2019Y ₂ -302	Yunnan
S004	K78S	Yunnan	R154	2019Y ₂ -306	Yunnan
S005	K47S	Yunnan	R155	2019Y ₂ -307	Yunnan
S006	K66S	Yunnan	R156	2019Y ₂ -308	Yunnan
S007	K63S	Yunnan	R157	2019Y ₂ -309	Yunnan
R001	2016Y ₂ -1987	Yunnan	R158	2019Y ₂ -311	Yunnan
R002	2016Y ₂ -2301	Yunnan	R159	2019Y ₂ -312	Yunnan
R003	2016Y ₂ -2652	Yunnan	R160	2019Y ₂ -319	Yunnan
R004	2016Y ₂ -2776	Yunnan	R161	2019Y ₂ -321	Yunnan
R005	2016Y ₂ -3613	Yunnan	R162	2019Y ₂ -324	Yunnan
R006	2016Y ₂ -3766	Yunnan	R163	2019Y ₂ -332	Yunnan
R007	2016Y ₂ -3768	Yunnan	R164	2019Y ₂ -338	Yunnan
R008	2016Y ₂ -3874	Yunnan	R165	2019Y ₂ -353	Yunnan
R009	2016Y ₂ -3876	Yunnan	R166	2019Y ₂ -357	Yunnan
R010	2016Y ₂ -3883	Yunnan	R167	2019Y ₂ -358	Yunnan
R011	2016Y ₂ -3884	Yunnan	R168	2019Y ₂ -366	Yunnan
R012	2016Y ₂ -3889	Yunnan	R169	2019Y ₂ -378	Yunnan
R013	2016Y ₂ -3901	Yunnan	R170	2019Y ₂ -407	Yunnan
R014	2016Y ₂ -3902	Yunnan	R171	2019Y ₂ -408	Yunnan
R015	2016Y ₂ -3913	Yunnan	R172	2019Y ₂ -409	Yunnan
R016	2016Y ₂ -3917	Yunnan	R173	2019Y ₂ -414	Yunnan
R017	2016Y ₂ -3919	Yunnan	R174	2019Y ₂ -418	Yunnan
R018	2016Y ₂ -3962	Yunnan	R175	2019Y ₂ -429	Yunnan
R019	2016Y ₂ -3972	Yunnan	R176	2019Y ₂ -432	Yunnan
R020	2016Y ₂ -3988	Yunnan	R177	2019Y ₂ -437	Yunnan
R021	2016Y ₂ -3989	Yunnan	R178	2019Y ₂ -438	Yunnan
R022	2016Y ₂ -4001	Yunnan	R179	2019Y ₂ -444	Yunnan
R023	2016Y ₂ -4022	Yunnan	R180	2019Y ₂ -449	Yunnan
R024	2016Y ₂ -4032	Yunnan	R181	2019Y ₂ -462	Yunnan
R025	2016Y ₂ -4033	Yunnan	R182	2019Y ₂ -465	Yunnan
R026	2016Y ₂ -4052	Yunnan	R183	2019Y ₂ -472	Yunnan
R027	2016Y ₂ -4078	Yunnan	R184	2019Y ₂ -473	Yunnan
R028	2016Y ₂ -4090	Yunnan	R185	2019Y ₂ -476	Yunnan
R029	2016Y ₂ -4094	Yunnan	R186	2019Y ₂ -477	Yunnan
R030	2016Y ₂ -4097	Yunnan	R187	2019Y ₂ -479	Yunnan
R031	2016Y ₂ -4098	Yunnan	R188	2019Y ₂ -482	Yunnan
R032	2016Y ₂ -4102	Yunnan	R189	2019Y ₂ -484	Yunnan
R033	2016Y ₂ -4106	Yunnan	R190	2019Y ₂ -489	Yunnan
R034	2016Y ₂ -4108	Yunnan	R191	2019Y ₂ -491	Yunnan
R035	2016Y ₂ -4111	Yunnan	R192	R185	Chongqin
R036	2016Y ₂ -4117	Yunnan	R193	RC1610	Chongqin
R037	2016Y ₂ -4118	Yunnan	R194	RCS133	Chongqin
R038	2016Y ₂ -4119	Yunnan	R195	2019Y ₄ -1	Yunnan

Supplementary Tables 1. Cont.

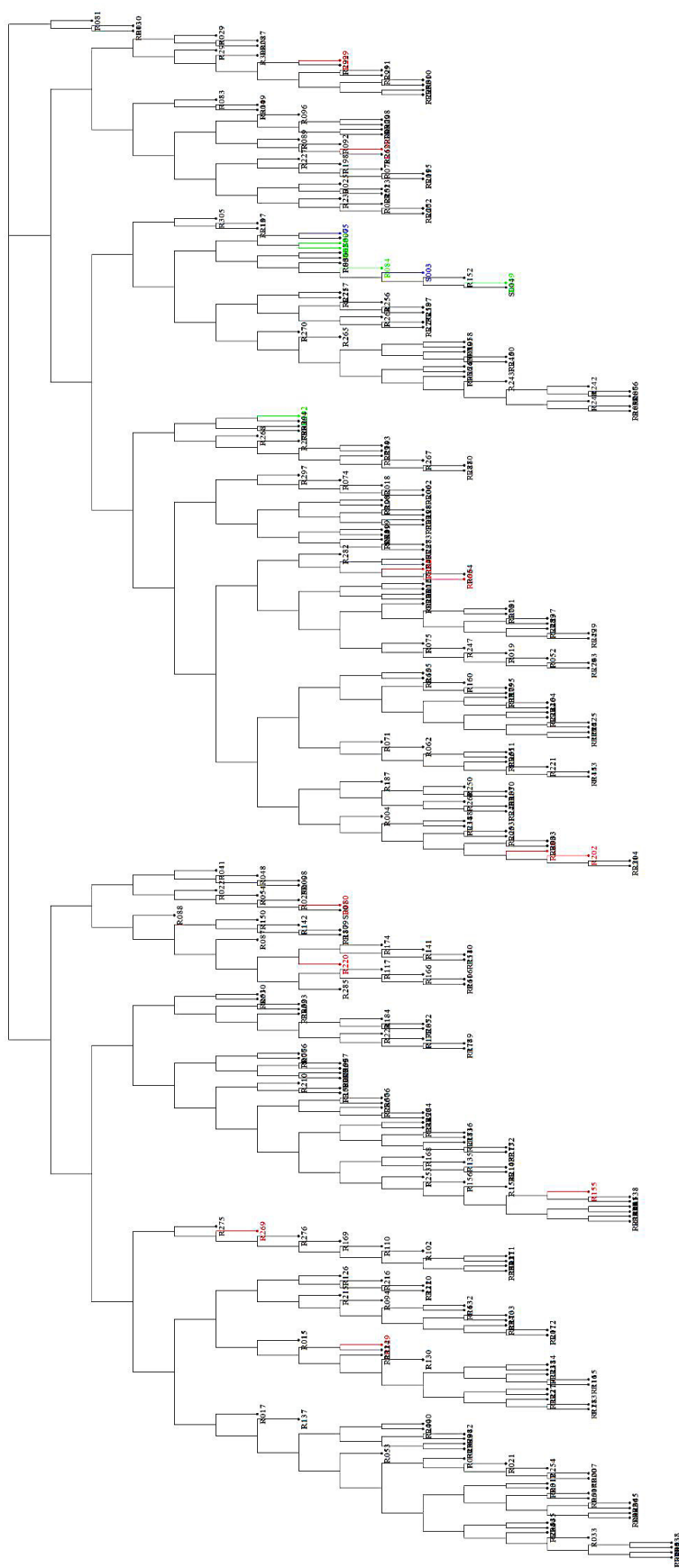
Genotype	Name	Source	Genotype	Name	Source
R039	2016Y ₂ -4122	Yunnan	R196	2019Y ₄ -2	Yunnan
R040	2016Y ₂ -4123	Yunnan	R197	2019Y ₄ -3	Yunnan
R041	2016Y ₂ -4124	Yunnan	R198	2019Y ₄ -4	Yunnan
R042	2016Y ₂ -4132	Yunnan	R199	2019Y ₄ -6	Yunnan
R043	2016Y ₂ -4134	Yunnan	R200	2019Y ₄ -7	Yunnan
R044	2016Y ₂ -4181	Yunnan	R201	2019Y ₄ -8	Yunnan
R045	2016Y ₂ -4183	Yunnan	R202	2019Y ₄ -10	Yunnan
R046	2016Y ₂ -4184	Yunnan	R203	2019Y ₄ -12	Yunnan
R047	2016Y ₂ -4197	Yunnan	R204	2019Y ₄ -13	Yunnan
R048	2016Y ₂ -4201	Yunnan	R205	Mianmai91	Sichuan
R049	2016Y ₂ -4203	Yunnan	R206	2019Y ₄ -15	Yunnan
R050	2016Y ₂ -4205	Yunnan	R207	2019Y ₄ -48	Yunnan
R051	2016Y ₂ -4208	Yunnan	R208	2019Y ₄ -51	Yunnan
R052	2016Y ₂ -4217	Yunnan	R209	2019Y ₄ -53	Yunnan
R053	2016Y ₂ -4221	Yunnan	R210	2019Y ₄ -54	Yunnan
R054	2016Y ₂ -4223	Yunnan	R211	2019Y ₄ -61	Yunnan
R055	2016Y ₂ -4224	CIMMYT	R212	2019Y ₄ -62	Yunnan
R056	2016C-1101	CIMMYT	R213	2019Y ₄ -63	Yunnan
R057	2016C-2012	CIMMYT	R214	2019Y ₄ -64	Yunnan
R058	2016C-6152	CIMMYT	R215	2019Y ₄ -65	Yunnan
R059	2016C-6203	CIMMYT	R216	2019Y ₄ -66	Yunnan
R060	2019Y ₂ -3	Yunnan	R217	2019Y ₄ -71	Yunnan
R061	2019Y ₂ -4	Yunnan	R218	2019Y ₄ -73	Yunnan
R062	2019Y ₂ -6	Yunnan	R219	2019Y ₄ -76	Yunnan
R063	2019Y ₂ -18	Yunnan	R220	2019Y ₄ -79	Yunnan
R064	2019Y ₂ -19	Yunnan	R221	2019Y ₄ -82	Yunnan
R065	2019Y ₂ -22	Yunnan	R222	2019Y ₄ -83	Yunnan
R066	2019Y ₂ -24	Yunnan	R223	2019Y ₄ -88	Yunnan
R067	2019Y ₂ -27	Yunnan	R224	2019Y ₄ -89	Yunnan
R068	2019Y ₂ -29	Yunnan	R225	2019Y ₄ -92	Yunnan
R069	2019Y ₂ -31	Yunnan	R226	2019Y ₄ -93	Yunnan
R070	2019Y ₂ -32	Yunnan	R227	2019Y ₄ -94	Yunnan
R071	2019Y ₂ -33	Yunnan	R228	2019Y ₄ -95	Yunnan
R072	2019Y ₂ -34	Yunnan	R229	2019DF-1	Yunnan
R073	2019Y ₂ -37	Yunnan	R230	2019DF-2	Yunnan
R074	2019Y ₂ -38	Yunnan	R231	2019DF-3	Yunnan
R075	2019Y ₂ -39	Yunnan	R232	2019DF-4	Yunnan
R076	2019Y ₂ -43	Yunnan	R233	2019DF-5	Yunnan
R077	2019Y ₂ -46	Yunnan	R234	2019DF-6	Yunnan
R078	2019Y ₂ -47	Yunnan	R235	2014Y ₂ -871	Yunnan
R079	2019Y ₂ -48	Yunnan	R236	2014Y ₂ -912	Yunnan
R080	2019Y ₂ -54	Yunnan	R237	2015Y ₂ -561	Yunnan
R081	2019Y ₂ -57	Yunnan	R238	2015Y ₂ -567	Yunnan
R082	2019Y ₂ -58	Yunnan	R239	2015Y ₂ -585	Yunnan
R083	2019Y ₂ -59	Yunnan	R240	2015Y ₂ -66	Yunnan
R084	2019Y ₂ -61	Yunnan	R241	2015Y ₂ -1431	Yunnan
R085	2019Y ₂ -63	Yunnan	R242	16C-1045	CIMMYT
R086	2019Y ₂ -66	Yunnan	R243	16C-1069	CIMMYT
R087	2019Y ₂ -67	Yunnan	R244	16C-1225	CIMMYT
R088	2019Y ₂ -68	Yunnan	R245	16C-3193	CIMMYT
R089	2019Y ₂ -72	Yunnan	R246	2016Y ₂ -64	Yunnan
R090	2019Y ₂ -74	Yunnan	R247	2016Y ₂ -1723	Yunnan
R091	2019Y ₂ -76	Yunnan	R248	2016Y ₂ -1957	Yunnan
R092	2019Y ₂ -82	Yunnan	R249	2016Y ₂ -1962	Yunnan
R093	2019Y ₂ -91	Yunnan	R250	2016Y ₂ -3954	Yunnan
R094	2019Y ₂ -98	Yunnan	R251	2016Y ₂ -4011	Yunnan
R095	2019Y ₂ -109	Yunnan	R252	2016Y ₂ -4226	Yunnan
R096	2019Y ₂ -112	Yunnan	R253	Yunxuan11-12	Yunnan

Supplementary Tables 1. Cont.

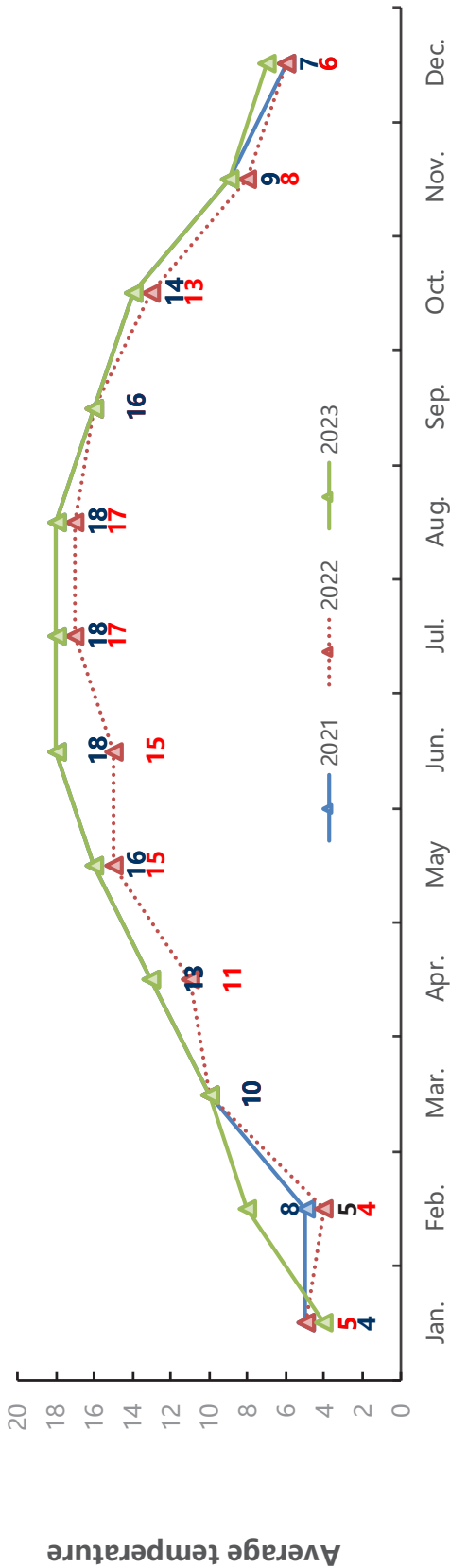
Genotype	Name	Source	Genotype	Name	Source
R097	2019Y ₂ -116	Yunnan	R254	Yunmai52	Yunnan
R098	2019Y ₂ -117	Yunnan	R255	Yunmai53	Yunnan
R099	2019Y ₂ -119	Yunnan	R256	Yunmai56	Yunnan
R100	2019Y ₂ -122	Yunnan	R257	Yunmai62	Yunnan
R101	2019Y ₂ -124	Yunnan	R258	Yunmai68	Yunnan
R102	2019Y ₂ -129	Yunnan	R259	Yunmai101	Yunnan
R103	2019Y ₂ -137	Yunnan	R260	Yunmai109	Yunnan
R104	2019Y ₂ -142	Yunnan	R261	Yunmai110	Yunnan
R105	2019Y ₂ -143	Yunnan	R262	Yunmai111	Yunnan
R106	2019Y ₂ -147	Yunnan	R263	Yunmai112	Yunnan
R107	2019Y ₂ -151	Yunnan	R264	Fengmai38	Yunnan
R108	2019Y ₂ -154	Yunnan	R265	Fengmai39	Yunnan
R109	2019Y ₂ -161	Yunnan	R266	Jingmai17	Yunnan
R110	2019Y ₂ -163	Yunnan	R267	Jingmai19	Yunnan
R111	2019Y ₂ -174	Yunnan	R268	Kunmai3	Yunnan
R112	2019Y ₂ -177	Yunnan	R269	Linmai15	Yunnan
R113	2019Y ₂ -184	Yunnan	R270	Linmai16	Yunnan
R114	2019Y ₂ -187	Yunnan	R271	Linmai6	Yunnan
R115	2019Y ₂ -188	Yunnan	R272	Wenmai11	Yunnan
R116	2019Y ₂ -193	Yunnan	R273	Wenmai14	Yunnan
R117	2019Y ₂ -194	Yunnan	R274	Wenmai9	Yunnan
R118	2019Y ₂ -196	Yunnan	R275	Chuanmai93	Sichuan
R119	2019Y ₂ -197	Yunnan	R276	Chuanmai98	Sichuan
R120	2019Y ₂ -199	Yunnan	R277	Chuanmai609	Sichuan
R121	2019Y ₂ -202	Yunnan	R278	Chuanmai610	Sichuan
R122	2019Y ₂ -204	Yunnan	R279	Chuanmai112	Sichuan
R123	2019Y ₂ -206	Yunnan	R280	Chuanmai42	Sichuan
R124	2019Y ₂ -208	Yunnan	R281	Chuanmai104	Sichuan
R125	2019Y ₂ -299	Yunnan	R282	Ningchun 53	Ningxia
R126	2019Y ₂ -301	Yunnan	R283	Qinnong 28	Shaanxi
R127	2019Y ₂ -397	Yunnan	R284	Zhengmai103	Henan
R128	2019Y ₂ -399	Yunnan	R285	Yongfeng101	Henan
R129	2019Y ₂ -401	Yunnan	R286	Zhoumai 18	Henan
R130	2019Y ₄ -46	Yunnan	R287	Zheng9023	Henan
R131	2019Y ₄ -47	Yunnan	R288	Nannong9918	Jiangsu
R132	2019Y ₂ -402	Yunnan	R289	Nannong0686	Jiangsu
R133	2019Y ₂ -217	Yunnan	R290	Aikang58	Henan
R134	2019Y ₂ -218	Yunnan	R291	Ningmai13	Jiangsu
R135	2019Y ₂ -231	Yunnan	R292	Yangmai15	Jiangsu
R136	2019Y ₂ -232	Yunnan	R293	Zhengmai366	Henan
R137	2019Y ₂ -233	Yunnan	R294	Shi4185	Hebei
R138	2019Y ₂ -234	Yunnan	R295	Zhenmai02166	Jiangsu
R139	2019Y ₂ -242	Yunnan	R296	Yangmai158	Jiangsu
R140	2019Y ₂ -246	Yunnan	R297	Mianmai26	Jiangsu
R141	2019Y ₂ -259	Yunnan	R298	Shumai482	Jiangsu
R142	2019Y ₂ -262	Yunnan	R299	J-1169	Jiangsu
R143	2019Y ₂ -266	Yunnan	R300	J-1188	Jiangsu
R144	2019Y ₂ -268	Yunnan	R301	G05	Jiangsu
R145	2019Y ₂ -271	Yunnan	R302	SL11	Jiangsu
R146	2019Y ₂ -276	Yunnan	R303	2018Y ₂ -599	Yunnan
R147	2019Y ₂ -278	Yunnan	R304	2018F3	Yunnan
R148	2019Y ₂ -281	Yunnan	R305	MR1238	Sichuan
R149	2019Y ₂ -284	Yunnan	R306	Tianmin138	Henan
R150	2019Y ₂ -287	Yunnan	R307	Tianmin198	Henan

Supplementary Tables 2. Genetic distances (GDs) of male sterile lines S003, S005, and 16 restorer lines based on SNP sequences were employed to produce 18 wheat hybrids

	S003	S005	R065	R068	R080	R084	R129	R139	R155	R159	R162	R192	R199	R202	R220	R228	R269
S003	-																
S005	0.43																
R065	0.53	0.51															
R068	0.32	0.29	0.44														
R080	0.36	0.40	0.52	0.33													
R084	0.29	0.44	0.48	0.40	0.47												
R129	0.63	0.54	0.49	0.54	0.52	0.52											
R139	0.18	0.32	0.53	0.26	0.25	0.25	0.60										
R155	0.52	0.48	0.59	0.42	0.50	0.58	0.65	0.47									
R159	0.36	0.29	0.46	0.10	0.40	0.44	0.56	0.31	0.40								
R162	0.54	0.50	0.04	0.43	0.50	0.49	0.47	0.53	0.62	0.45							
R192	0.57	0.35	0.46	0.36	0.46	0.54	0.46	0.48	0.47	0.36	0.46						
R199	0.64	0.42	0.44	0.39	0.52	0.55	0.50	0.62	0.52	0.36	0.45	0.32					
R202	0.54	0.50	0.41	0.39	0.44	0.59	0.47	0.54	0.49	0.35	0.37	0.48	0.42				
R220	0.52	0.51	0.45	0.46	0.42	0.56	0.56	0.56	0.58	0.46	0.43	0.53	0.46	0.35			
R228	0.55	0.48	0.38	0.38	0.45	0.58	0.46	0.57	0.52	0.37	0.34	0.48	0.43	0.06	0.34		
R269	0.60	0.47	0.54	0.59	0.57	0.45	0.48	0.54	0.66	0.58	0.55	0.53	0.53	0.59	0.59	0.58	
R299	0.56	0.54	0.51	0.50	0.47	0.51	0.37	0.55	0.57	0.53	0.50	0.52	0.55	0.52	0.48	0.52	0.54



Supplementary Figure 1. The evolutionary tree based on 15K SNP markers and different (near and far) genetic distances of all 307 and seven sterile lines [Note: The used sterile lines colored blue and the near genetic distances of restorer lines colored by green and the far and middle genetic distances colored by red]



Supplementary Figure 2. Average temperature of every month from 2021 to 2023 at Jiajing experimental farm of the Yuxi Academy of Agricultural Sciences in Yanhe Town, Yuxi City, Yunnan Province