

## Supplementary Materials

### **NGS-based multiplex assay of trait-linked molecular markers revealed the genetic diversity of Iranian bread wheat landraces and cultivars**

*Ehsan Rabieyan<sup>A</sup> and Hadi Alipour<sup>B,C</sup>*

<sup>A</sup>Department of Agronomy and Plant Breeding, Faculty of Agricultural Sciences and Engineering, University of Tehran, Karaj, Iran.

<sup>B</sup>Department of Plant Production and Genetics, Faculty of Agriculture and Natural Sciences, Urmia University, Urmia, Iran.

<sup>C</sup>Corresponding author. Email: [ha.alipour@urmia.ac.ir](mailto:ha.alipour@urmia.ac.ir)

**Table S1. Characteristics of 99 Iran wheat cultivars.**

Entry No	Year	Variety Name	Growth Habit	Variety Type	Pedigree	Selection History	Origin
1	1951	4820	Spring	Bread Wheat		Algeria	No Info
2	1976	ADL	Spring	Bread Wheat	TK/SHAHPASSAND		Cross made in the country, one CIMMYT parent
3	2010	AFLAK	Spring	Bread Wheat	HD160/5/Tob/Cno/23854/3/Nai60//Tit/Son64/4/LR/Son64	S-80-18	CIMMYT advanced line
4	2006	AKBARI	Spring	Bread Wheat	1-63-31/3/12300/TOB//CNO67/SX		Cross made in the country, no CIMMYT parents
5	1978	ALBORZ	Spring	Bread Wheat	FN/MD//K117A/3/2*CLLF/4/SON64/KLRE/3/CNO//LR64*2/SON64	CM2182	CIMMYT segregating line or population
6	2006	ARTA	Spring	Bread Wheat	HD2206/Hork//Bul/6/CMH80A.253/2/M2A/CML//Ald*4/5/BH1146/H56.71//BH1146/3/CMH78.390/4/Seri82/7/Hel/3*Cno79/7/2*Seri82		Cross made in the country, no CIMMYT parents
7	1979	AZADI	Facultative	Bread Wheat	4820/1.32.15409//8156	-0IRN	Cross made in the country, one CIMMYT parent
8	1957	AZAR	Winter	Bread Wheat	AZAR,LV	-0IRN	Cross made in the country, no CIMMYT parents
9	1976	BAYAT	Spring	Bread Wheat	PUNJAB-76/CHENAB-70	-0DAR	Cross made in the country, one CIMMYT parent
10	1980	BISTON	Spring	Bread Wheat	9-36/592/PIEVE or 9-36-562/PIAVE	-0IRN	Cross made in the country, one CIMMYT parent
11	1997	CHAMRAN	Spring	Bread Wheat	ND/VG9144//KAL/BB/3/YACO/4/V EE#5	CM85836-4Y-0M-0Y-8M-0Y-0PZ	CIMMYT advanced line
12	2013	CHAMRAN-2	Spring	Bread Wheat	Attila 50Y//Attila/Bacanora		CIMMYT advanced line
13	1980	DARAB 1	Spring	Bread Wheat	RSH/IRN 149(60-61)//C271	-0IRN	Cross made in the country, one CIMMYT parent
14	1995	DARAB 2	Spring	Bread Wheat	MAYA'S/NAC	CM39424-1Y-1M-4Y-1M-1Y-1M-0Y	CIMMYT advanced line

15	1960	DASTJERDI	Spring	Bread Wheat	DASTJERDI	-0IRN	Cross made in the country, no CIMMYT parents
16	1968	DAYHIM	Spring	Bread Wheat	DIADEM/ITALIAI	-0K	Cross made in the country, no CIMMYT parents
17	---	DN-11					No Info
18	1990	FALAT	Spring	Bread Wheat	KVZ/BUHO//KAL/BB	CM33027-F-15M-500Y-0M-87B-0Y	CIMMYT segregating line or population
19	---	FONG					No Info
20	---	FONTANA					No Info
21	1996	GAHAR	Spring	Bread Wheat	ND/VG9144//KAL/BB/3/YACO'S/4/VEE#5	CM85836-45Y-0M-4M-0Y-0MRGH	CIMMYT advanced line
22	1988	GHODS	Spring	Bread Wheat	RHS/5/WT/4/NOR10/K54*2//FN/3/PTR/6/OMID//KAL/BB	-0IRN	Cross made in the country, one CIMMYT parent
23	1986	GOLESTAN	Spring	Bread Wheat	D6301/NAI60//WRM/3/CNO*2/CHR	CM11683-0IRN	Cross made in the country, one CIMMYT parent
24	2009	HOMA	Winter	Bread Wheat	A pure Line of Sardari	0MAR	Cross made in the country, no CIMMYT parents
25	1974	KARAJ 1	Facultative	Bread Wheat	200H/VFN/RSH	-0K	Cross made in the country, one CIMMYT parent
26	1974	KARAJ 2	Winter	Bread Wheat	FA//TH/MTA/3/OMI or FA//TH/MT/3/OMID	-0K	Cross made in the country, no CIMMYT parents
27	1974	KARAJ 3	Winter	Bread Wheat	DRC/MXP//ISWRN-297/3/NAI60	-0K	Cross made in the country, no CIMMYT parents
28	2011	KARIM	Spring	Bread Wheat	Triticum aestivum/Sprw "s"//CA8055/3/Baconora88	ICW92-0477-1AP-1AP-4AP-1AP-0AP	Cross made in the country, no CIMMYT parents
29	1994	Gascogne					No Info
30	1980	KAVEH	Spring	Bread Wheat	FTA/PL	-0IRN	Cross made in the country, no CIMMYT parents
31	1974	KHAZAR 1	Spring	Bread Wheat	P4160//SN64/LR64	-0G	CIMMYT segregating line or population

32	2002	KOOHDASHT	Spring	Bread Wheat	BB/RON//CNO67/TOTA/3/JAR	TR810200-29R-1R-6R-0R-0IRN	CIMMYT advanced line
33	1995	MAHDAVI	Spring	Bread Wheat	TI/PCH/5/MT48/3/WTE*3/NAR59/TOTA63/4/MUS	ICW84	Cross made in the country, one CIMMYT parent
34	1991	MAROON	Spring	Bread Wheat	AVD/PCHU/5/N10/BR21.1C//KT54B/3/NAR59/1093/4/7C		Cross made in the country, one CIMMYT parent
35	2010	MIHAN	Winter	Bread Wheat	Barkat/90Zhong87		Cross made in the country, one CIMMYT parent
36	1974	MOGHAN 1	Spring	Bread Wheat	LR/N10B//3*ANE	II8739-4R-1M-1R-0IRN	Cross made in the country, one CIMMYT parent
37	1974	MOGHAN 2	Spring	Bread Wheat	LR64A/HUAR	II15929-1M-4R-2M-0IND-0IRN	CIMMYT segregating line or population
38	2006	MOGHAN 3	Spring	Bread Wheat	Luan/3/V763.23/V879.c8//Pvn/4/Picus/5/Opata	N-80-6	Cross made in the country, no CIMMYT parents
39	2009	MORVARID	Spring	Bread Wheat	MILAN/SHANGHAI-7	CM97550-0M-2Y-030H-3Y-3Y-0Y-2M-010Y-0FUS-3FUS-1FUS-0Y-2SJ-0Y	CIMMYT advanced line
40	1993	MV-17	Winter	Bread Wheat		Marton Vassar, Hungry	Cross made in the country, no CIMMYT parents
41	1990	NAVID	Facultative	Bread Wheat	HYS/7C		CIMMYT advanced line
42	1978	NAZ	Spring	Bread Wheat	II12300//LR64A/8156/3/NOR	II30842-31R-2M-2Y-0M-0IRN	CIMMYT advanced line
43	2006	NEISHABOUR	Spring	Bread Wheat	1-63-31/3/12300/TOB//CNO67/SX		Cross made in the country, no CIMMYT parents
44	1995	NICKNEJAD	Spring	Bread Wheat	F134-71/CROW'S'	SWM11147-1AP-2AP-4AP-1AP-0AP-0MRGH	CIMMYT segregating line or population
45	2012	OFOGH	Spring	Bread Wheat	GF-gy54/Attila	Cross made in Iran at SPII in 1995. Cross #1-14437	Cross made in the country, one CIMMYT parent

46	2010	OHADI	Winter	Bread Wheat	Selection in landraces		Cross made in the country, no CIMMYT parents
47	1968	PANJAMO 62	Spring	Bread Wheat			Cross made in the country, no CIMMYT parents
48	2008	PISHGAM	Facultative	Bread Wheat	Bkt/90Zhong87	0K	Cross made in the country, no CIMMYT parents
49	2014	QABOOS	Spring	Bread Wheat	Dryland Agricultural Research Institute		No Info
50	1942	RAYHANI	Spring	Bread Wheat	RAYHANI	0IRN	Cross made in the country, no CIMMYT parents
51	2011	RIJAW	Facultative	Bread Wheat	PATO/CAL/3/7C//BB/CNO/5/CAL//CNO/SN64/4/CNO//BAD/CHR/3/KL./6/SABALAN	IWWIP	Cross made in the country, no CIMMYT parents
52	1994	SIOSSON					No Info
53	1946	SEFIDAK	Facultative	Bread Wheat	SEFIDAK	0IRN	Cross made in the country, no CIMMYT parents
54	1967	SHAHI	Winter	Bread Wheat	SHAHI	0IRN	Cross made in the country, no CIMMYT parents
55	1942	SHAHPASSAND	Winter	Bread Wheat	SHAHPASSAND	0IRN	Cross made in the country, no CIMMYT parents
56	2012	SIRVAN	Spring	Bread Wheat	PRL/2*PASTOR	CGSS97Y00034M-099TOPB-027Y-099M-099Y-099M-27Y-0B	Cross made in the country, one CIMMYT parent
57	2006	SISTAN	Spring	Bread Wheat	Bank"s"/Veery"s"		Cross made in the country, one CIMMYT parent
58	2013	TAK-AB	Winter	Bread Wheat	Manning/Sdv1//Dogu88	0YC-0YC-0YC-12YC-0YC	Cross made in the country, no CIMMYT parents
59	2002	TOUS	Facultative	Bread Wheat	SPN/MCD//CAM/3/NZR or SPN/MCD//CAMA/3/NZT	SWM777627'-17H-4H-1H-0H	CIMMYT advanced line

60	1969	TOBARI 66	Spring	Bread Wheat				Cross made in the country, no CIMMYT parents
61	2009	UROUM	Winter	Bread Wheat	Alvand//Ns732/Her			Cross made in the country, no CIMMYT parents
62	1997	VEE/NAC	Spring	Bread Wheat	Veery/Nacozari or Veery#5/NacozariF76	CM67575		Cross made in the country, no CIMMYT parents
63	2010	ZARE	Facultative	Bread Wheat	130L1.11//F35.70/MO73/4/YMH/TOB//MCD/3/LIRA	CIT925080-0SE-0YC-7YC-0YC-1YC-0YC-3YC-0YC		Cross made in the country, no CIMMYT parents
64	1995	ZARRIN	Facultative	Bread Wheat	NAI60/HVII//BUC/3/F59.71/GHK	SWO791095		CIMMYT advanced line
65	---	SHANGHAI #7	Spring	Bread Wheat				No Info
66	1969	INIA 66	Spring	Bread Wheat	LR64/SN64	II19008-83M-100Y-100M-100Y-100C		CIMMYT advanced line
67	2009	MISR 1	Facultative	Bread Wheat	OASIS/SKAUZ//4*BCN/3/2*PASTOR	CMSS00Y01881T-050M-030Y-030M-030WGY-33M-0Y-0S		No Info
68	348	MUNAL #1						No Info
69	2005	RASK	Spring	Bread Wheat	Kauz/Yaco//Kauz	CRG 873-5Y-010M-0Y-0PAK		No Info
70	1974	ARVAND 1	Spring	Bread Wheat	RSH/3/MTA//KY/MAYO58	-0IRN		Cross made in the country, one CIMMYT parent
71	1966	BAJIO	Spring	Bread Wheat	SN64A//TZPP/NAI60	II18889-4M-1Y-1M-3Y-0MEX		CIMMYT advanced line
72	1960	ROSHAN	Spring	Bread Wheat	Landrace	-0IRN		Cross made in the country, no CIMMYT parents
73	353	ARGELATO						No Info
74	354	AROONA						No Info
75	1970	BARTA	Facultative	Bread Wheat	LEE/FN//SOUTH AFRICA 43/MAYO 54			Cross made in the country, no CIMMYT parents
76	1968	RASHID	Facultative	Bread Wheat	N.P.7881/AZAR 2/588	-01IRN		Cross made in the country, one CIMMYT parent

77	1980	SABALAN	Facultative	Bread Wheat	(908/FN/A12)1-32-4382	-0IRN	Cross made in the country, one CIMMYT parent
78	2006	DARYA	Spring	Bread Wheat	Sha4/Chil		Cross made in the country, one CIMMYT parent
79	1995	ATRAK	Spring	Bread Wheat	JUP/BJY'S//URES	CM67458-4Y-1M-3Y-1M-3Y-0B	CIMMYT advanced line
80	2007	BAHAR	Spring	Bread Wheat	HD2172/3/BB/2*7C//Y50E/3*KAL	ICW84.0008-013AP-300L-3AP-300L-0AP-0IRN	Cross made in the country, no CIMMYT parents
81	2006	SEPAHAN	Spring	Bread Wheat	AZADI/5/L2453/1347/4/KAL//BB/KAL/3/Y50E/3*KAL	-0ISF	Cross made in the country, no CIMMYT parents
82	2006	BAM	Spring	Bread Wheat	VEE#5/NAC//1-66-22 or VEERY/NAC0ZARI-76//1-66-22	DH-4-209-1577-F3	Cross made in the country, no CIMMYT parents
83	2002	SHIRAZ	Spring	Bread Wheat	GV/D6301//ALD/3/AZADI or GAVILAN,MEX/D-630//(SIB)ALONDRA/3/AZADI or ALVAND//ALDAN/IAS-58	-0IRN	Cross made in the country, one CIMMYT parent
84	2002	PISHTAZ	Spring	Bread Wheat	ALVAND//ALDAN/IAS 58	-0IRN	Cross made in the country, one CIMMYT parent
85	2002	HAMOON	Spring	Bread Wheat	FALAT/RSH	-0IRN	Cross made in the country, one CIMMYT parent
86	2002	DEZ	Spring	Bread Wheat	KAUZ*2/OPATA//KAUZ	CRG737-1Y-010M-0Y-0IRN	CIMMYT advanced line
87	1997	SHIROODI	Spring	Bread Wheat	ND/VG9144//KAL/BB/3/YACO/4/V EE#5	CM85836-4Y-0M-0Y-8M-0Y-0PZ-0IRN	CIMMYT advanced line
88	1999	MARVDASHT	Spring	Bread Wheat	HD2172/BLOUDAN//AZADI	-0SHZ	Cross made in the country, one CIMMYT parent
89	1996	ZAGROS	Spring	Bread Wheat	TAN'S'/VEE'S//OPATA	CM82781-030TOPM-14Y-025H-05H-0SY-05RB-0H-0MRGH	CIMMYT advanced line
90	1997	CHAMRAN_C	Spring	Bread Wheat	ND/VG9144//KAL/BB/3/YACO/4/V EE#5	CM85836-4Y-0M-0Y-8M-0Y-0PZ	CIMMYT advanced line

91	1995	TAJAN	Spring	Bread Wheat	BOW/NKT	CM67428-6M-1Y-05M-3Y-0B-0K	CIMMYT advanced line
92	1995	ALVAND	Facultative	Bread Wheat	1-27-6275/CF 1770 or CF17170 1-22-11	0K	Cross made in the country, one CIMMYT parent
93	1997	KAVIR	Spring	Bread Wheat	Stm/3/Kal//V543/Jit716 or SHORTIM/3/KALYANSONA//V-534/JIT-716		Cross made in the country, one CIMMYT parent
94	2009	PARSI	Spring	Bread Wheat	Dove"S"/Buc"S"//2*Darab1 or DOVE(SIB)/(SIB)BUCKBUCK(M-84-17)//2*DARAB		Cross made in the country, one CIMMYT parent
95	2009	SIVAND	Spring	Bread Wheat	Kauz"S"/Azd or KAUZ(SIB)/(AZD)AZADI	M-84-18	Cross made in the country, no CIMMYT parents
96	1969	BEZOSTAYA	Winter	Bread Wheat	LUTESCENS17/SKOROSPELKA2		Cross made in the country, no CIMMYT parents
97	1958	AKOVA	Winter	Bread Wheat			No Info
98	2002	SHAHRYAR	Winter	Bread Wheat	KVZ/TI/MAYA/26591-1T-7M-OY-115Y-OM/3/1-44-21863/4/ANZA/3/PI/NAR59//HYS or KAVKAZ/TANORI-71/3/MAYA-74(SIB)//BLUEBIRD/INIA/4/KARAJ-2/5/ANZA/3/PITIC-62/NDR//HYSLOP	-0IRN	Cross made in the country, one CIMMYT parent
99	1997	AZAR 2	Winter	Bread Wheat	KVZ/TI/MAYA/26591-1T-7M-OY-115Y-OM/3/SEFID	IMW88.1.10838-0MRGH-0MRGH-0MRGH-3MRGH-0MRGH	Cross made in the country, one CIMMYT parent



**Table S2. Characteristics of 270 Iran wheat landraces.**

Entry No	Collected year	LOC ID	UT PROVINCE	UT CITY	UCD IWA NO	PACK NO	UT ACC NO	USDA PI NO	CIMMYT NO
1	1957	164	Gilan	GILAN	8610601	4652	5778-6	625275	CWI66865
2	1959	164	Gilan	GILAN	8610607	4658	6084-2	625278	CWI66871
3	1959	164	Gilan	GILAN	8610608	4659	6084-3	625279	CWI66872
4	1960	164	Gilan	GILAN	8610616	4666.1	6779-5	625281	CWI72398
5	1962	348	Mazandaran	BABOL	8610990	5039	7333-4	625362	CWI72463
6	1959	247	Khorasan	MASHHAD	8611151	5201	6432-3	625433	CWI67144
7	1939	247	Khorasan	MASHHAD	8612039	6090	1719-1	625661	CWI67524
8	1961	247	Khorasan	MASHHAD	8612438	6489	7156-3	625810	CWI72729
9	1961	247	Khorasan	MASHHAD	8612839	6891	7039-1	625928	CWI72952
10	1966	211	Kerman	KERMAN	8613108	8070	7678-7	626030	CWI73086
11	1950	211	Kerman	KERMAN	8613311	8274	5418-6	626156	CWI67670
12	1950	211	Kerman	KERMAN	8613313	8276	5418-8	626158	CWI67672
13	1956	211	Kerman	KERMAN	8613423	8389	5758-8	626215	CWI67751
14	1966	372	Sistan-Balouchestan	ZAHEDAN	8613434	8400	7705-2	626223	CWI67758
15	1959	372	Sistan-Balouchestan	ZAHEDAN	8613437	8403	6358-2	626226	CWI67761
16	1966	372	Sistan-Balouchestan	ZAHEDAN	8613445	8411	7701-3	626234	CWI67769
17	1961	308	Markazi	SAVEH	8609608	3657	6845-2	625080	CWI72118
18	1961	308	Markazi	SAVEH	8609609	3658	6845-3	625081	CWI72119
19	1966	327	Markazi	KASHAN	8609715	3765	7657-6	625123	CWI57793
20	1966	327	Markazi	KASHAN	8609721	3771	7655-2	625127	CWI72194
21	1939	311	Markazi	ARAK	8609750	3800	1761-2	625139	CWI72197
22	1956	164	Gilan	GILAN	8610514	4564	5747-1	625250	CWI66818
23	1959	359	Mazandaran	MAZANDARAN	8610561	4613	6218-2	625263	CWI66843
24	1961	372	Sistan-Balouchestan	ZAHEDAN	8613474	8441	7149-3	626260	CWI67794
25	1966	372	Sistan-Balouchestan	ZAHEDAN	8613477	8444	7694-1	626261	CWI67795
26	1964	104	Esfahan	ESFAHAN	8613658	8624	7518-2	626358	CWI67880
27	1964	104	Esfahan	ESFAHAN	8613661	8627	7518-5	626360	CWI67883
28	1964	104	Esfahan	ESFAHAN	8614310	9298	7456-1	626565	CWI73421
29	1964	104	Esfahan	ESFAHAN	8614311	9299	7456-2	626566	CWI73422
30	1964	104	Esfahan	ESFAHAN	8614330	9318	7457-2	626573	CWI73433
31	1957	203	Ilam	ILAM	8600080	281	5781-8	626699	CWI54496
32	1959	186	Hamadan	MALAYER	8600090	294	6251-2	626706	CWI54502
33	1961	255	Khorasan	SABZVAR	8600138	602	7003-2	626736	CWI70918
34	1964	379	Yazd	ARDAKAN	8600154	656	7496-2	626747	CWI54538
35	1964	384	Yazd	YAZD	8600186	758	7607-1	626764	CWI70927
36	1961	225	Khorasan	BIRJAND	8600205	822	7063-3	626776	CWI54569
37	1961	104	Esfahan	ESFAHAN	8600261	979	7277-2	626814	CWI54602
38	1961	143	Esfahan	SHAHREZA	8600276	1011	6926-5	626825	CWI54613
39	1964	384	Yazd	YAZD	8600308	1068	7575-3	626846	CWI54636
40	1961	228	Khorasan	BOJNOURD	8600313	1082	7055-1	626850	CWI54638

41	1961	344	Markazi	VARAMIN	8600319	1096	7034-1	626855	CWI54641
42	1960	153	Fars	SHIRAZ	8600342	1147	6786-2	626872	CWI54656
43	1961	216	Kerman	SIRJAN	8600409	1312	7272-5	626908	CWI54704
44	1961	153	Fars	SHIRAZ	8600421	1328	6823-3	626917	CWI54712
45	1960	161	Gilan	ASTARA	8600429	1342	6778-2	626923	CWI70975
46	1960	161	Gilan	ASTARA	8600430	1343	6778-3	626924	CWI70976
47	1961	200	Hormozgan	BANDAR- ABBAS	8600442	1370	7280-3	626932	CWI54727
48	1941	19	Azarbayjan-Shargi	ARDABIL	8600366	1181	3189-8	626881	CWI54674
49	1961	151	Fars	NIRIZ	8600368	1183	6822-2	626883	CWI54676
50	1961	149	Fars	FASA	8600371	1198	6810-1	626885	CWI54679
51	1941	37	Azarbayjan-Shargi	MARAGHEH	8600389	1267	3201-2	626895	CWI54690
52	1939	42	Azarbayjan-Shargi	MIANEH	8600405	1308	2180-2	626904	CWI70970
53	1959	398	Zanjan	ZANJAN	8600669	1698	6010-1	627072	CWI54871
54	1959	283	Khouzestan	KHORAM- ABAD	8600710	1759	6272-1	627099	CWI54894
55	1960	395	Zanjan	ROUD-BAR	8600715	1766	6781-1	627102	CWI54897
56	1961	357	Mazandaran	GORGAN	8600716	1768	7102-3	627103	CWI71040
57	1961	228	Khorasan	BOJNOURD	8600882	2009	7125-1	627189	CWI55011
58	1960	395	Zanjan	ROUD-BAR	8600643	1654	6780-1	627055	CWI54858
59	1961	162	Gilan	FOOMAN	8600645	1661	6835-5	627056	CWI71019
60	1961	162	Gilan	FOOMAN	8600647	1663	6835-7	627057	CWI71020
61	1939	311	Markazi	ARAK	8600652	1671	1756-1	627061	CWI71022
62	1961	214	Kerman	RAFSANJAN	8600661	1687	7262-4	627066	CWI54866
63	1961	200	Hormozgan	BANDAR- ABBAS	8600444	1373	7280-2	626933	CWI54729
64	1961	220	Kerman	ZABOL	8600461	1397	7149-2	626943	CWI54737
65	1961	14	Azarbayjan-Gharbi	REZAIEH	8600484	1430	6939-2	626958	CWI54756
66	1964	104	Esfahan	ESFAHAN	8600515	1472	7513-5	626978	CWI54778
67	1959	94	Bakhtaran	SHAH-ABAD	8600538	1502	61555-7	626993	CWI54796
68	1959	282	Khouzestan	BROUJERD	8600612	1619	6269-1	627036	CWI71007
69	1959	282	Khouzestan	BROUJERD	8600613	1620	6269-2	627037	CWI54843
70	1959	282	Khouzestan	BROUJERD	8600614	1621	6269-3	627038	CWI71008
71	1959	14	Azarbayjan-Gharbi	REZAIEH	8600621	1629	6347-2	627043	CWI54848
72	1960	170	Gilan	ROUD-BAR	8600642	1653	6779-1	627054	CWI54857
73	1961	242	Khorasan	GONABAD	8600968	2153	7021-1	627236	CWI74139
74	1964	74	Bakhtaran	KANGAVAR	8600978	2169	7427-2	627243	CWI55067
75	1961	242	Khorasan	GONABAD	8600983	2178	7247-2	627247	CWI71097
76	1959	52	Azarbayjan-Shargi	TABRIZ	8602030	240	6060-1	627268	CWI55093
77	1939	311	Markazi	ARAK	8602061	342	1847-2	627283	CWI55114
78	1964	381	Yazd	DASTJERD	8602098	729	7439-3	627299	CWI55130
79	1961	200	Hormozgan	BANDAR- ABBAS	8602207	1374	7280-7	627356	CWI55188
80	1939	311	Markazi	ARAK	8602213	1668	2031-1	627359	CWI55192
81	1961	214	Kerman	RAFSANJAN	8602214	1692	7262-3	627360	CWI55193

82	1961	65	Bakhtaran	GHASRE-SHIRIN	8602273	77	6960-12	627385	CWI55230
83	1959	394	Zanjan	MANJIL	8602304	129	6073-1	627399	CWI71169
84	1959	37	Azarbayjan-Shargi	MARAGHEH	8602331	158	6126-1	627410	CWI55256
85	1957	74	Bakhtaran	KANGAVAR	8602335	162	5783-1	627414	CWI71177
86	1959	91	Bakhtaran	SANJABI	8602337	164	6313-2	627416	CWI71179
87	1959	91	Bakhtaran	SANJABI	8602339	166	6469-2	627417	CWI55260
88	1959	174	Hamadan	HAMADAN	8602354	182	6229-3	627423	CWI55267
89	1961	255	Khorasan	SABZVAR	8602436	526	7002-1	627460	CWI71203
90	1964	379	Yazd	ARDAKAN	8602511	593	7497-4	627484	CWI74159
91	1964	379	Yazd	ARDAKAN	8602566	657	7496-2	627501	CWI55376
92	1959	52	Azarbayjan-Shargi	TABRIZ	8603258	312	6485-2	627787	CWI55542
93	1966	211	Kerman	KERMAN	8603985	459	7685-3	627842	CWI71344
94	1966	370	Sistan-Balouchestan	ZABOL	8603997	472	7702-2	627845	CWI74356
95	1966	370	Sistan-Balouchestan	ZABOL	8604008	484	7706-3	627849	CWI71348
96	1966	370	Sistan-Balouchestan	ZABOL	8604012	489	7708-2	627852	CWI71351
97	1966	370	Sistan-Balouchestan	ZABOL	8604015	493	7709-1	627853	CWI71352
98	1940	364	Mazandaran	SARI	8604040	521	2660-2	627856	CWI71356
99	1959	392	Zanjan	GAZVIN	8604084	571	5933-1	627873	CWI55596
100	1959	169	Gilan	RASHT	8604088	578	6065-1	627876	CWI71369
101	1959	169	Gilan	RASHT	8604089	579	6065-2	627877	CWI55597
102	1963	131	Esfahan	NAEIN	8603128	155	7388-5	627688	CWI55508
103	1940	384	Yazd	YAZD	8603178	219	2897-5	627723	CWI74261
104	1959	42	Azarbayjan-Shargi	MIANEH	8603190	234	5978-3	627735	CWI74268
105	1959	25	Azarbayjan-Shargi	AZAR-SHAHR	8603227	278	6043-1	627759	CWI74295
106	1959	25	Azarbayjan-Shargi	AZAR-SHAHR	8603229	280	6043-3	627760	CWI74296
107	1960	151	Fars	NIRIZ	8602674	1149	6786-4	627543	CWI55442
108	1953	19	Azarbayjan-Shargi	ARDABIL	8602698	1337	5620-2	627551	CWI74170
109	1947	174	Hamadan	HAMADAN	8602825	157	5178-5	627575	CWI74183
110	1959	284	Kordestan	BANEH	8602975	306	6100-2	627587	CWI74193
111	1956	104	Esfahan	ESFAHAN	8603025	32	5756-6	627616	CWI74214
112	1959	52	Azarbayjan-Shargi	TABRIZ	8604095	588	6482-2	627881	CWI71371
113	1959	52	Azarbayjan-Shargi	TABRIZ	8604097	590	6482-4	627882	CWI71372
114	1959	52	Azarbayjan-Shargi	TABRIZ	8604098	591	6482-5	627883	CWI55600
115	1959	347	Mazandaran	AMOL	8604142	641	6218-1	627905	CWI71388
116	1959	311	Markazi	ARAK	8604146	645	6268-2	627908	CWI55610
117	1959	174	Hamadan	HAMADAN	8604148	648	6237-3	627909	CWI55611
118	1959	52	Azarbayjan-Shargi	TABRIZ	8604160	664	6523-1	627917	CWI55618
119	1959	308	Markazi	SAVEH	8604263	790	6472-1	627948	CWI71411
120	1947	174	Hamadan	HAMADAN	8604293	828	5178-2	627963	CWI55642
121	1959	344	Markazi	VARAMIN	8604324	868	6474-4	627973	CWI55647
122	1959	392	Zanjan	GAZVIN	8604358	908	5987-10	627987	CWI55657
123	1959	55	Bakhtaran	BAKHTARAN	8604367	918	6161-12	627990	CWI55659
124	1931	326	Markazi	KARAJ	8604383	938	474-4	627998	CWI55664
125	1959	203	Ilam	ILAM	8604417	979	6345-2	628005	CWI71439

126	1959	55	Bakhtaran	BAKHTARAN	8604459	1034	6291-1	628012	CWI55673
127	1940	104	Esfahan	ESFAHAN	8604610	1227	2713-4	628062	CWI55712
128	1964	131	Esfahan	NAEIN	8604655	1283	7406-1	628082	CWI55721
129	1959	357	Mazandaran	GORGAN	8604658	1288	6214-2	628084	CWI55723
130	1959	311	Markazi	ARAK	8604666	1299	6344-4	628088	CWI55727
131	1964	143	Esfahan	SHAHREZA	8604706	1345	7547-3	628114	CWI55746
132	1959	398	Zanjan	ZANJAN	8604781	1433	6061-2	628149	CWI55775
133	1959	203	Ilam	ILAM	8604850	1510	6351-6	628189	CWI55795
134	1959	286	Kordestan	BIJAR	8609087	3128	6326-4	621619	CWI71852
135	1931	376	Tehran	TEHRAN	8609174	3215	497-1	621650	CWI74531
136	1931	376	Tehran	TEHRAN	8609190	3231	501-5	621661	CWI74534
137	1931	376	Tehran	TEHRAN	8609212	3254	489-8	621668	CWI71888
138	1931	376	Tehran	TEHRAN	8609214	3256	489-3	621669	CWI74548
139	1959	156	Gazvin	GHAZVIN	8609312	3356	6063-1	621704	CWI71907
140	1940	156	Gazvin	GHAZVIN	8609315	3359	2754-1	621706	CWI71910
141	1959	156	Gazvin	GHAZVIN	8609332	3380	5938-7	621712	CWI71923
142	1948	156	Gazvin	GHAZVIN	8609338	3386	5254-2	621714	CWI71927
143	1948	156	Gazvin	GHAZVIN	8609342	3390	5254-6	621716	CWI71929
144	1940	203	Ilam	ILAM	8606103	25360-6	2338-3	620887	CWI55900
145	1959	3	Azarbayjan-Gharbi	AZ-GH	8606156	884/	6036-2	620902	CWI55923
146	1959	3	Azarbayjan-Gharbi	AZ-GH	8606159	887	6503-2	620903	CWI55925
147	1959	174	Hamadan	HAMADAN	8607898		6301-1	621420	CWI57018
148	1959	174	Hamadan	HAMADAN	8607899		6301-2	621421	CWI57019
149	1959	55	Bakhtaran	BAKHTARAN	8608259	2296	6136-6	621492	CWI57240
150	1959	174	Hamadan	HAMADAN	8608561	2601	6221-3	621536	CWI57453
151	1959	174	Hamadan	HAMADAN	8608624	2665	6232-2	621549	CWI71791
152	1958	174	Hamadan	HAMADAN	8608669	2710	5889-3	621565	CWI57495
153	1958	174	Hamadan	HAMADAN	8608671	2712	5889-5	621566	CWI57497
154	1940	164	Gilan	GILAN	8610517	4567	2694-2	622069	CWI72387
155	1959	359	Mazandaran	MAZANDARAN	8610560	4612	6218-1	622084	CWI72392
156	1957	164	Gilan	GILAN	8610600	4651	5778-5	622098	CWI66864
157	1959	164	Gilan	GILAN	8610603	4654	6070-1	622099	CWI66867
158	1956	164	Gilan	GILAN	8610615	4666	5747-3	622105	CWI72397
159	1956	364	Mazandaran	SARI	8610962	5011	5694-2	622247	CWI72458
160	1962	348	Mazandaran	BABOL	8610987	5036	7333-1	622264	CWI49895
161	1962	347	Mazandaran	AMOL	8610997	5046	7335-1	622272	CWI67063
162	1959	247	Khorasan	MASHHAD	8611149	5199	6432-1	622310	CWI67142
163	1959	247	Khorasan	MASHHAD	8611152	5202	6432-4	622311	CWI72495
164	1960	156	Gazvin	GHAZVIN	8609348	3396	6719-2	621717	CWI71931
165	1948	156	Gazvin	GHAZVIN	8609375	3423	5255-1	621735	CWI71953
166	1948	156	Gazvin	GHAZVIN	8609376	3424	5255-2	621736	CWI71954
167	1959	311	Markazi	ARAK	8609894	3943	6267-4	621869	CWI72226
168	1939	311	Markazi	ARAK	8609967	4016	2040-1	621907	CWI72270
169	1939	311	Markazi	ARAK	8609968	4017	2040-2	621908	CWI72271
170	1939	311	Markazi	ARAK	8609969	4018	2040-3	621909	CWI72272

171	1959	311	Markazi	ARAK	8610128	4178	6261-1	621972	CWI66710
172	1959	398	Zanjan	ZANJAN	8610422	4472	5961-2	622040	CWI66776
173	1959	398	Zanjan	ZANJAN	8610503	4553	5934-2	622063	CWI72383
174	1964	381	Yazd	DASTJERD	8600170	723	7439-2	623109	CWI54547
175	1961	153	Fars	SHIRAZ	8600348	1153	6830-3	623123	CWI54661
176	1961	153	Fars	SHIRAZ	8600362	1178	6814-4	623125	CWI54670
177	1961	149	Fars	FASA	8600364	1180	6813-2	623127	CWI54672
178	1959	14	Azarbayjan-Gharbi	REZAEIH	8600387	1262	6350-8	623131	CWI54688
179	1964	104	Esfahan	ESFAHAN	8614078	9064	7564-6	623002	CWI68045
180	1964	104	Esfahan	ESFAHAN	8614087	9074	7556-3	623008	CWI74680
181	1964	104	Esfahan	ESFAHAN	8614329	9317	7457-1	623069	CWI73432
182	1940	94	Bakhtaran	SHAH-ABAD	8600045	230	2243-1	623090	CWI54471
183	1957	247	Khorasan	MASHHAD	8600048	232	5806-1	623091	CWI70894
184	1939	247	Khorasan	MASHHAD	8611155	5205	1991-2	622312	CWI72497
185	1939	247	Khorasan	MASHHAD	8611157	5207	1991-4	622314	CWI67145
186	1939	247	Khorasan	MASHHAD	8611170	5220	1718-4	622319	CWI72504
187	1961	247	Khorasan	MASHHAD	8611291	5342	7069-1	622379	CWI67210
188	1959	247	Khorasan	MASHHAD	8611380	5396	6458-1	622402	CWI67241
189	1953	211	Kerman	KERMAN	8613350	8316	5606-4	622840	CWI49921
190	1953	211	Kerman	KERMAN	8613388	8354	5604-3	622847	CWI67723
191	1964	104	Esfahan	ESFAHAN	8613659	8625	7518-3	622894	CWI67881
192	1962	104	Esfahan	ESFAHAN	8613706	8673	7330-4	622905	CWI67904
193	1966	104	Esfahan	ESFAHAN	8613869	8839	7662-1	622930	CWI73305
194	1947	14	Azarbayjan-Gharbi	REZAEIH	8602192	1136	5208-3	623266	CWI55181
195	1957	68	Bakhtaran	GILANE- GHARB	8602279	104	5791-13	623274	CWI55234
196	1959	197	Hamadan	TOYSERKAN	8602365	193	6547-2	623291	CWI55276
197	1964	379	Yazd	ARDAKAN	8602543	631	7499-2	623318	CWI71221
198	1961	153	Fars	SHIRAZ	8602686	1229	6829-6	623338	CWI74167
199	1961	216	Kerman	SIRJAN	8602692	1272	7272-2	623340	CWI71246
200	1957	68	Bakhtaran	GILANE- GHARB	8602889	220	5788-3	623344	CWI74186
201	1959	284	Kordestan	BANEH	8602981	312	6098-1	623345	CWI74198
202	1950	217	Kerman	SOOFI-ABAD	8603165	203	5418-7	623377	CWI74252
203	1956	210	Kerman	JIROFT	8603167	205	5758-2	623379	CWI74254
204	1941	10	Azarbayjan-Gharbi	MAHABAD	8600439	1364	3227-6	623136	CWI54724
205	1961	153	Fars	SHIRAZ	8600462	1397	6823-2	623139	CWI54738
206	1959	282	Khouzestan	BROUJERD	8600615	1623	6269-5	623160	CWI54844
207	1961	10	Azarbayjan-Gharbi	MAHABAD	8600624	1632	6943-1	623161	CWI54849
208	1961	10	Azarbayjan-Gharbi	MAHABAD	8600626	1634	6943-3	623162	CWI54851
209	1960	170	Gilan	ROUD-BAR	8600668	1696	6779-5	623169	CWI71025
210	1961	225	Khorasan	BIRJAND	8600725	1779	7045-3	623176	CWI54903
211	1939	247	Khorasan	MASHHAD	8600761	1846	1820-3	623183	CWI71050
212	1959	326	Markazi	KARAJ	8602033	244	6559-4	623254	CWI55095
213	1959	392	Zanjan	GAZVIN	8602055	286	6068-1	623256	CWI55109

214	1959	3	Azarbayjan-Gharbi	AZ-GH	8606161	889	6503-4	623510	CWI55927
215	1957	79	Bakhtaran	KERMANSHAH	8607380	12104-1	5783-2	623905	CWI71625
216	1957	79	Bakhtaran	KERMANSHAH	8607383	12103	5783-5	623908	CWI56702
217	1957	79	Bakhtaran	KERMANSHAH	8607384	13475-7	5784-1	623909	CWI56703
218	1957	65	Bakhtaran	GHASRE-SHIRIN	8607446	12551-5	5797-5	623953	CWI56757
219	1958	197	Hamadan	TOYSERKAN	8607499	10837-4	5851-2	623980	CWI56798
220	1959	174	Hamadan	HAMADAN	8607897		6299-3	624215	CWI57017
221	1959	203	Ilam	ILAM	8607949	40733-3	6352-2	624240	CWI57057
222	1959	203	Ilam	ILAM	8607960	40779-8	6354-3	624251	CWI57068
223	1940	203	Ilam	ILAM	8606083	18704-7	2230-2	623475	CWI55893
224	1940	203	Ilam	ILAM	8606137	18948-5	2852-2	623503	CWI71582
225	1968	79	Bakhtaran	KERMANSHAH	8606149	57952-5	8032-1	623506	CWI71586
226	1968	79	Bakhtaran	KERMANSHAH	8606150	57957-6	8032-2	623507	CWI55919
227	1968	79	Bakhtaran	KERMANSHAH	8606151	57962-6	8032-3	623508	CWI55920
228	1956	210	Kerman	JIROFT	8603170	209	5758-5	623382	CWI74256
229	1966	370	Sistan-Balouchestan	ZABOL	8604017	494	7709-3	623417	CWI71353
230	1959	52	Azarbayjan-Shargi	TABRIZ	8604099	592	6482-6	623421	CWI71373
231	1959	52	Azarbayjan-Shargi	TABRIZ	8604394	950	6060-2	623428	CWI55665
232	1939	203	Ilam	ILAM	8606081	18937-4	2160-2	623473	CWI55891
233	1959	174	Hamadan	HAMADAN	8608622	2662	6234-1	624596	CWI71789
234	1959	65	Bakhtaran	GHASRE-SHIRIN	8608963	3004	6154-1	624804	CWI57692
235	1959	65	Bakhtaran	GHASRE-SHIRIN	8608964	3005	6154-2	624805	CWI57693
236	1959	65	Bakhtaran	GHASRE-SHIRIN	8608965	3006	6154-3	624806	CWI71836
237	1931	203	Ilam	ILAM	8608986	3027	382-2	624818	CWI71841
238	1959	203	Ilam	ILAM	8609011	3052	6353-1	624837	CWI57721
239	1959	203	Ilam	ILAM	8609012	3053	6353-2	624838	CWI57722
240	1957	203	Ilam	ILAM	8609020	3061	5781-1	624846	CWI57730
241	1957	203	Ilam	ILAM	8609023	3064	5781-4	624849	CWI57733
242	1959	203	Ilam	ILAM	8609036	3077	6354-2	624861	CWI57745
243	1961	292	Kordestan	KORDESTAN	8608123	2156	6941-1	624315	CWI57161
244	1959	292	Kordestan	KORDESTAN	8608132	2165	6166-3	624321	CWI71739
245	1959	55	Bakhtaran	BAKHTARAN	8608261	2298	6280-2	624378	CWI57242
246	1959	55	Bakhtaran	BAKHTARAN	8608266	2303	6360-5	624381	CWI57247
247	1959	174	Hamadan	HAMADAN	8608563	2603	6222-2	624576	CWI57455
248	1959	174	Hamadan	HAMADAN	8608574	2615	6147-6	624580	CWI57460
249	1959	174	Hamadan	HAMADAN	8608580	2619	6229-2	624582	CWI57463
250	1959	174	Hamadan	HAMADAN	8608583	2622	6242-1	624585	CWI71781
251	1946	376	Tehran	TEHRAN	8609206	3247	5164-2	624944	CWI74544
252	1948	376	Tehran	TEHRAN	8609211	3253	5251-3	624946	CWI74546
253	1931	376	Tehran	TEHRAN	8609213	3255	489-2	624947	CWI74547
254	1948	376	Tehran	TEHRAN	8609233	3277	5261-3	624956	CWI71892

255	1931	376	Tehran	TEHRAN	8609251	3295	500-9	624963	CWI74564
256	1959	156	Gazvin	GHAZVIN	8609319	3363	6079-2	624980	CWI71913
257	1959	156	Gazvin	GHAZVIN	8609322	3366	6079-6	624983	CWI71916
258	1959	156	Gazvin	GHAZVIN	8609327	3375	5938-2	624985	CWI71918
259	1947	156	Gazvin	GHAZVIN	8609356	3404	5239-1	624990	CWI71938
260	1961	308	Markazi	SAVEH	8609534	3582	6843-2	625047	CWI72063
261	1959	203	Ilam	ILAM	8609038	3079	6351-1	624863	CWI57746
262	1959	203	Ilam	ILAM	8609039	3080	6351-2	624864	CWI57747
263	1959	286	Kordestan	BIJAR	8609086	3127	6326-3	624894	CWI74495
264	1960	286	Kordestan	BIJAR	8609094	3135	6717-5	624900	CWI71853
265	1960	286	Kordestan	BIJAR	8609095	3136	6717-6	624901	CWI74501
266	1959	190	Hamadan	NAHAVAND	8609110	3151	6282-2	624910	CWI74508
267	1959	190	Hamadan	NAHAVAND	8609111	3152	6282-3	624911	CWI74509
268	1959	186	Hamadan	MALAYER	8609153	3194	6345-1	624925	CWI71875
269	1931	376	Tehran	TEHRAN	8609197	3238	484-1	624939	CWI74537
270	1931	376	Tehran	TEHRAN	8609200	3241	484-4	624941	CWI74540

**Table S3. Primer sequence of GBMAS markers.**

<b>Marker</b>	<b>Trait</b>	<b>Chromosome</b>	<b>GBMAS Forward Primer*</b>	<b>GBMAS Reverse Primer**</b>
<b>APRsnp3788</b>	APR	2D	AAGAAGCAACCTCGACGTT	TCAAACCATAAATGGAGCGG
<b>csSr2</b>	Stem rust	3BS	CCATTGCTCTACACAACAAG	CTTTAGCAGCGTTACTTCC
<b>Fhb1_319</b>	FHB	3BS	ACCAGTTGTACTGAATTCAG	GTGTTACGAGGTATTGACC
<b>Fhb1_cg8</b>	FHB	3BS	AGCGACTTTTCTCTGGTCTG	TGGCACTACCACAAGTACAG
<b>GluD1_umn26_4777</b>	Gluten strength	1D	GTACTAGCACGATAGTCAC	TATATGCATCCGTGTCTCG
<b>GWt7AL-IWA5913</b>	Grain weight	7AL	TCTAGACCACCTGTGTGTAC	TGGATCAGAGGTAGCAATAC
<b>HF6B-IWA5780</b>	Hessian fly	6B	ATTCCTGAAAGCGTTCAAGG	ACGCCAGGTTATGTAAAC
<b>HF6B-IWA921</b>	Hessian fly	6B	AACATTGGGTACATGCACAG	TCGAGAAGATGAAGTACGAC
<b>Lr34Exon11</b>	Leaf rust	7D	ATCTGCATGCTCATCTCTG	GCTTGCCATTATTGCACTC
<b>Lr34Exon12</b>	Leaf rust	7D	GTTCTTCTGCCAGTTTCTG	TGAAGCCTCCGAATGTAAG
<b>Lr34Exon22Jag</b>	Leaf rust	7D	TGAAAGCCTGTAGAAGGTG	GCGTATTGTAATGTATCGTG
<b>Lr34Intron4</b>	Leaf rust	7D	TAACCATGACACCGACATC	GTGTTGAATCTCAGGATGC
<b>Lr42-113325_01</b>	Leaf rust	1D	TCATTGGGTGACCTAAGAC	CTCCTTCCTCATATGAGAC
<b>Lr42-TC425250_08</b>	Leaf rust	1D	TCTGAGTCTTCACAAACGC	ACCTAGGTATTCAGAGTGG
<b>Lr46-Yr29-JF2</b>	Leaf rust	1BL	CCATCTTAATATGCAACTCG	CTTGAGCGTTGGTATTAAG
<b>PHS4A_34586_92</b>	Preharvest sprouting	4A	TTCTCGTGCTTGTGCGGTC	TCGTTGATCGCGCACAATG
<b>Sr39_Rwg27</b>	Stem rust	2B	CAGTCATCATTGTCATGG	GTGAACAAACCTGCAGTAAC
<b>SBM-SNP198467</b>	Soil-borne mosaic virus	5D	TCATCGAAACAACGAGAGG	CACTGCAATGAGTAGGTAG
<b>SBMV_JD_c4438_5568170</b>	Soil-borne mosaic virus	5D	TGCCTTCACAAGTTCTCTG	TTTTTGTCGTTGAGGTTTCC
<b>Sr22_Seg2</b>	Stem rust	7AL	GCGGATATTTCCACAATGC	TTTACTGGTGTATGCTGC
<b>Sr26_Res</b>	Stem rust	6AL	GCCTACGTAGATACCTTAC	CATCCAAGAATCATGACCC
<b>Sr26_Sus</b>	Stem rust	6AL	TGACTTCTTGAGGCAACAAC	GGATGATTTAGGCACGAATG
<b>Sr39-Sr40-Sr32_Seg4.1</b>	Stem rust	2B	AACAGTGCTTCTTAGAAAGG	TGATAAAGCCACATGACGG
<b>Sr35_CNL9</b>	Stem rust	3AL	TAGCTCCCTCACTGATAAC	CTATGTTCCACAAGGAGC
<b>Sr39-Seg5</b>	Stem rust	2B	ACAGGAAAAAGAGGCAGAG	GCTAGCTAGCATGTGAATG
<b>TaPHS1-3AS</b>	Preharvest sprouting	3AS	GTGCAATTTACATGTGAATGG	TTGTGTCTGCAGGATAGTG
<b>Vrn1_design3</b>	Vernalization	5A	GTTTCAGTGAGCTTTCCAG	CGATTTTGTTGATTGCCAG
<b>Wsm2-SNP6660</b>	Wheat streak mosaic	3B?	ATCACAGCCCTGAAGGAC	TCGGTGTTTCAGCTTTCTTG



<b>Wsm2-SNP80940</b>	Wheat streak mosaic	3B?	TGGAGGTTATTTGACGGAG	TGGACATTCTGTCTCTTCG
<b>BX7oe</b>	Gluten strength	1B	TCACGCCATCACTAATATTC	TAGTTTTAGTTCTCATATCC
<b>GWt7AL-IWB6693</b>	Grain weight	7AL	GCCGTCTACCATGTCTATG	CCACAAGAAAAGAGCAAGAC
<b>GWt7AL-IWB13913</b>	Grain weight	7AL	CGAACTTCGATCATAGATTAG	TAGTAAGCTCTTCAACGAGG
<b>HF6B-2475</b>	Hessian fly	6B	ATTGTGTGTGTTGAGCTCG	TCGGTGTGATTCAAATGGG
<b>PHS_MFT-3A</b>	Preharvest sprouting	3A	TATGGCTTACGCTAAGCAG	GACCTGTACATGCATGATC
<b>PHS4A_34562_92</b>	Preharvest sprouting	4A	TCCATGCATCATAGGAAAAC	GCTTCTGTCCCTTACTTTG
<b>PHS4A_8081_92</b>	Preharvest sprouting	4A	TGGTGTTCGAAAAACAATGG	AATCAGAACCCATCGCCC
<b>Rht1B</b>	Plant height	4B	TGGGTGGCGAAGCTGTC	TCGGGTACAAGGTGCGG
<b>Rht2D</b>	Plant height	4D	TCGGGTACAAGGTGCGC	TGGGTGGCGAAGCTGTC
<b>Sr22_Seg1</b>	Stem rust	7AL	GAAAATGAACTGAATGGATG	GCTGATGGATGAAAAAGGTG
<b>Tsn1</b>	Tan spot	5B	CAGGAATAGAAAAGTAGAGAG	AGCATCCCCCTGCCCTTC
<b>Uhw89</b>	Grain protein content	6B	TTATGGGAGTAGGTTGGTG	CTAAGAAAGGGAGAGAGAG
<b>Vrn-A1_9K0001</b>	Vernalization	5A	ATCCATCTTTTGCTTTCCTG	CAGAGCACACCAAAGTAAG

\*add M13 tail GATGTAAAACGACGGCCAGTG to 5'-end of forward primer

\*\*add CCTCTCTATGGGCAGTCGGTGAT to 5'-end of reverse primer