Table S1. Origin and Pedigree of durum wheat varieties.

Durum wheat varieties	**Origin**	**Pedigree**
Azeghar2-1(56)	ICARDA, SYR	Selection from AZEGHAR2: 20048Traikia(Mor)/Mrb5//Stj3
Sebatel2-45	ICARDA, SYR	Selection from Sebatel-2//Wdz6/Gil4 (ICD02-0992-C-12AP-0AP-2AP-0AP-2AP-0AP)
Icajin 38(64)	ICARDA, SYR	Selection from Icajihan1 (ICD01-0251-T-4AP-TR-1AP-0AP)
Mv-Makaroni	HUNGARY	Selected from MTA-ATK Martonvasar (HU) crosses
Mv-Pelsodur	HUNGARY	Selected from MTA-ATK Martonvasar (HU) crosses
MVTD15-19	HUNGARY	Selected from MTA-ATK Martonvasar (HU) crosses
MVTD20-19	HUNGARY	Selected from MTA-ATK Martonvasar (HU) crosses
Mv-Vekadur	HUNGARY	Selected from MTA-ATK Martonvasar (HU) crosses
Iride	ITALY	Altar 84/Ares (= Ionio)
Saragolla	ITALY	Iride/Linea PSB 0114 PBS
Senatore Cappelli	ITALY	Selection from North African landraces Jennah Khetifa
Vulci	MA	Varieties released by Syngenta Company in the Mediterranean area
Fuego	MA	Varieties released by Syngenta Company in the Mediterranean area
Gibraltar	MA	Varieties released by Syngenta Company in the Mediterranean area
HFN 94n	Unknown origin	

Table S2. The 38 co-dominant SSR markers associated with traits important for organic farming.

Biotic stress	**Chr.**	**Marker**	**References**
POWDERY MILDEW	**5BL**	wmc75	Alam, M. A., Mandal, M. S. N., Wang, C., & Ji, W. (2013). Chromosomal location and SSR markers of a powdery mildew resistance gene in common wheat line N0308. African Journal of microbiology research, 7(6), 477-482.
LEAF RUST	**1B**	gwm18	Kthiri, D., Loladze, A., N'Diaye, A., Nilsen, K. T., Walkowiak, S., Dreisigacker, S., & Pozniak, C. J. (2019). Mapping of genetic loci conferring resistance to leaf rust from three globally resistant durum wheat sources. Frontiers in Plant Science, 10, 1247.
LEAF RUST	**1B**	Xbarc187	Kthiri, D., Loladze, A., N'Diaye, A., Nilsen, K. T., Walkowiak, S., Dreisigacker, S., & Pozniak, C. J. (2019). Mapping of genetic loci conferring resistance to leaf rust from three globally resistant durum wheat sources. Frontiers in Plant Science, 10, 1247.
FUSARIUM	**7A**	gwm282	Jia, G., Chen, P., Qin, G., Bai, G., Wang, X., Wang, S., ... & Liu, D. (2005). QTLs for Fusarium head blight response in a wheat DH population of Wangshuibai/Alondra's'. Euphytica, 146, 183-191.
POWDERY MILDEW	**5BL**	gpw7425	Alam, M. A., Mandal, M. S. N., Wang, C., & Ji, W. (2013). Chromosomal location and SSR markers of a powdery mildew resistance gene in common wheat line N0308. African Journal of microbiology research, 7(6), 477-482.
LEAF RUST	**7B**	barc340	Maccaferri, M., Mantovani, P., Tuberosa, R., DeAmbrogio, E., Giuliani, S., Demontis, A., ... & Sanguineti, M. C. (2008). A major QTL for durable leaf rust resistance widely exploited in durum wheat breeding programs maps on the distal region of chromosome arm 7BL. Theoretical and Applied Genetics, 117, 1225-1240.
FUSARIUM	**3B**	barc133	Buerstmayr, M., Huber, K., Heckmann, J., Steiner, B., Nelson, J. C., & Buerstmayr, H. (2012). Mapping of QTL for Fusarium head blight resistance and morphological and developmental traits in three backcross populations derived from Triticum dicoccum× Triticum durum. Theoretical and Applied Genetics, 125, 1751-1765.
Pyrenophora tritici-repentis (Died.)	**3B**	gwm285	Singh, P. K., Gonzalez-Hernandez, J. L., Mergoum, M., Ali, S., Adhikari, T. B., Kianian, S. F., ... & Hughes, G. R. (2006). Identification and molecular mapping of a gene conferring resistance to Pyrenophora tritici-repentis race 3 in tetraploid wheat. Phytopathology, 96(8), 885-889.
Yield and quality		**Marker**	
Grain protein content - TKW	**5AS**	barc117	Conti, V., Roncallo, P. F., Beaufort, V., Cervigni, G. L., Miranda, R., Jensen, C. A., & Echenique, V. C. (2011). Mapping of main and epistatic effect QTLs associated to grain protein and gluten strength using a RIL population of durum wheat. Journal of applied genetics, 52, 287-298.
Grain weight	**1B**	Xgwm413	Tyagi, S., Mir, R. R., Balyan, H. S., & Gupta, P. K. (2015). Interval mapping and meta-QTL analysis of grain traits in common wheat (Triticum aestivum L.). Euphytica, 201, 367-380.

Grain weight	**1B**	Xgwm413	Zanke, C. D., Ling, J., Plieske, J., Kollers, S., Ebmeyer, E., Korzun, V., ... & Röder, M. S. (2015). Analysis of main effect QTL for thousand grain weight in European winter wheat (Triticum aestivum L.) by genome-wide association mapping. Frontiers in plant science, 6, 644.
Grain protein content	**3BS**	barc147	Conti, V., Roncallo, P. F., Beaufort, V., Cervigni, G. L., Miranda, R., Jensen, C. A., & Echenique, V. C. (2011). Mapping of main and epistatic effect QTLs associated to grain protein and gluten strength using a RIL population of durum wheat. Journal of applied genetics, 52, 287-298.
Grain protein content - GY	**3BS**	wms493	Conti, V., Roncallo, P. F., Beaufort, V., Cervigni, G. L., Miranda, R., Jensen, C. A., & Echenique, V. C. (2011). Mapping of main and epistatic effect QTLs associated to grain protein and gluten strength using a RIL population of durum wheat. Journal of applied genetics, 52, 287-298.
Grain protein content	**4AL**	barc170	Conti, V., Roncallo, P. F., Beaufort, V., Cervigni, G. L., Miranda, R., Jensen, C. A., & Echenique, V. C. (2011). Mapping of main and epistatic effect QTLs associated to grain protein and gluten strength using a RIL population of durum wheat. Journal of applied genetics, 52, 287-298.
Sedimentation index	**1BL**	cfa2129	Conti, V., Roncallo, P. F., Beaufort, V., Cervigni, G. L., Miranda, R., Jensen, C. A., & Echenique, V. C. (2011). Mapping of main and epistatic effect QTLs associated to grain protein and gluten strength using a RIL population of durum wheat. Journal of applied genetics, 52, 287-298.
Root traits			
Root angle	**3AS**	wms5	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.
ROOT ANGLE - Dough strenght	**5BS**	gwm234	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.
primary root length	**2AS**	gwm636	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.
Root angle	**5A**	wms205	
total seminal root length	**7AL**	cfa2257	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.
primary root length	**5AL**	wmc727	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.
Root angle	**4al**	gwm637	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.

Root angle	**6AS**	gwm459	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.
Root angle	**6A**	gwm427	Cane, M. A., Maccaferri, M., Nazemi, G., Salvi, S., Francia, R., Colalongo, C., & Tuberosa, R. (2014). Association mapping for root architectural traits in durum wheat seedlings as related to agronomic performance. Molecular Breeding, 34, 1629-1645.
ROOT ANGLE - GPC	**5BL**	gwm499	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.
Shoot length - Heading day			
Flowering time (Vrn-B1)	**5B**	Xgwm408	Marzario, S., Logozzo, G., David, J. L., Zeuli, P. S., & Gioia, T. (2018). Molecular genotyping (SSR) and agronomic phenotyping for utilization of durum wheat (Triticum durum Desf.) ex situ collection from Southern Italy: a combined approach including pedigreed varieties. Genes, 9(10), 465.
Heading day	**3BS**	Xgwm389	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.
Heading day	**2AL**	cfa2086	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.
Heading day	**3BS**	gwm566	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.
Heading day	**1AL**	gwm99	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.
Heading day	**7AS/7BS**	gwm573.2	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.
Shoot length	**3AS/3BS**	wmc505.1	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.
Shoot length/RDW (mg)/SDW (mg)	**6BL**	Xbarc134	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.

Shoot length/RDW (mg)/TRL (cm)	**3AL**	gwm155	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.
shoot length - Heading Day	**7BL**	Xgwm46	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.
Shoot length	**2A/2B**	Xcfd50	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.
Shoot length	**5BL**	gwm213	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.
Shoot length	**7AL**	gwm332	Sanguineti, M. C., Li, S., Maccaferri, M., Corneti, S., Rotondo, F., Chiari, T., & Tuberosa, R. (2007). Genetic dissection of seminal root architecture in elite durum wheat germplasm. Annals of Applied Biology, 151(3), 291-305.

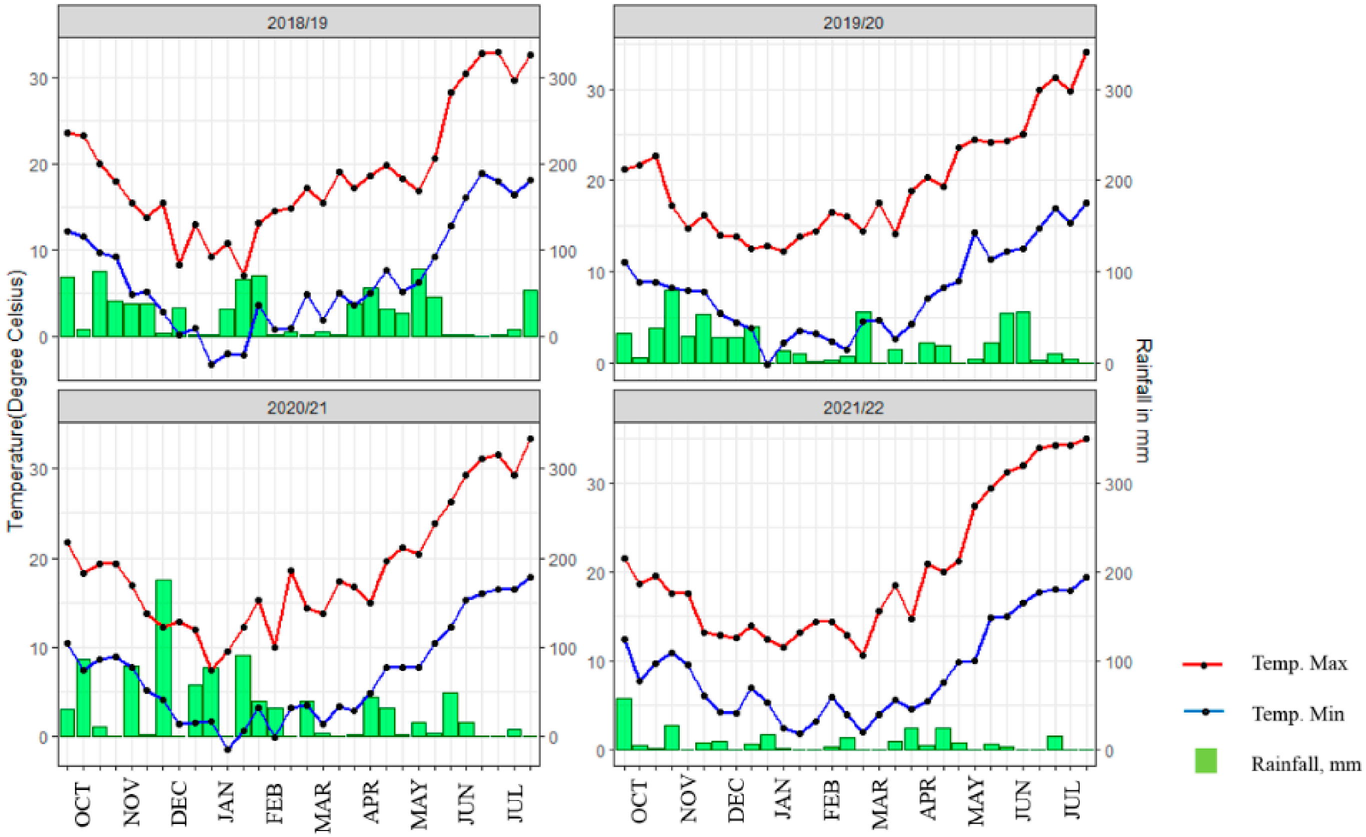

Figure S1. Climate data for four seasons.

A

	type	Code	Y	PC1	PC2	PC3
	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<dbl>
1	GEN	Azeghar2-1(56)	34.02	0.3326	1.289	-1.205
2	GEN	Fuego	36.95	1.111	-0.5720	-1.261
3	GEN	Gibraltar	34.38	0.09797	1.070	1.132
4	GEN	HFN 94n	35.17	-0.3390	-0.7768	-0.07659
5	GEN	Icajin 38(64)	44.9	-0.6372	-0.5784	0.02539
6	GEN	Iride	36.9	0.8744	0.8816	-0.1988
7	GEN	MVTD15-19	32.08	0.3423	-0.7966	0.6969
8	GEN	MVTD20-19	36.23	-0.2097	-0.08911	0.06336
9	GEN	Mv-Makaroni	36.52	0.5731	-0.9875	0.3971
10	GEN	Mv-Pelsodur	37.13	-0.9515	0.8643	0.7887
11	GEN	Mv-Vekadur	35.02	1.134	-0.5717	0.2480
12	GEN	Saragolla	33.52	1.508	-0.03842	-0.08633
13	GEN	Sebatel2-45	37.07	-2.466	-0.9547	-0.6972
14	GEN	Senatore Cappelli	44.12	-1.066	1.212	-0.4420
15	GEN	Vulci	34.65	-0.3051	0.04811	0.6154
16	ENV	IT2019	40.03	2.666	-1.639	-0.1279
17	ENV	IT2020	42.04	-2.137	-0.9767	1.534
18	ENV	IT2021	31.73	0.9780	2.505	0.6032
19	ENV	IT2022	32.50	-1.508	0.1107	-2.009

B

	type	Code	Y	PC1	PC2	PC3
	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<dbl>
1	GEN	Azeghar2-1(56)	79.75	-0.4258	0.05410	0.2337
2	GEN	Fuego	81.57	-0.5855	-0.4681	-0.1350
3	GEN	Gibraltar	81.83	-0.8796	-0.1130	0.3052
4	GEN	HFN 94n	80.03	1.259	-0.2731	-0.04911
5	GEN	Icajin 38(64)	81.31	0.6571	-0.8842	-0.7298
6	GEN	Iride	81.22	-0.5433	0.2567	-0.7845
7	GEN	MVTD15-19	78.6	-0.05935	1.192	0.1532
8	GEN	MVTD20-19	77.41	0.1571	-0.5958	0.6608
9	GEN	Mv-Makaroni	78.2	-0.8791	0.01806	-0.3862
10	GEN	Mv-Pelsodur	79.86	-0.06631	-0.03367	0.1823
11	GEN	Mv-Vekadur	80.27	-0.1440	0.4898	-0.05956
12	GEN	Saragolla	78.81	0.2943	0.5376	0.2741
13	GEN	Sebatel2-45	79.17	0.7078	-0.1650	0.2324
14	GEN	Senatore Cappelli	82.04	-0.3701	-0.7489	0.2899
15	GEN	Vulci	78.69	0.8782	0.7330	-0.1873
16	ENV	IT2019	80.62	0.7466	1.054	-0.9569
17	ENV	IT2020	80.27	0.9073	0.5037	1.109
18	ENV	IT2021	78.91	-2.088	0.2247	0.08940
19	ENV	IT2022	79.87	0.4346	-1.782	-0.2411

Figure S2. Additive main effects and multiplicative interaction (AMMI 1) biplots show GEI of the 15 durum wheat varieties under 4 environments for **A** – thousand kernel weight (TKG), and **B** – The test weight (HLW).

A

	type	Code	Y	PC1	PC2	PC3
	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<dbl>
1	GEN	Azeghar~	42.83	-0.2420	-1.213	1.376
2	GEN	Fuego	48.21	-1.041	-0.5894	-0.3410
3	GEN	Gibralt~	42.52	-0.4908	-0.3847	0.9382
4	GEN	HFN 94n	43.85	1.413	1.309	-0.3336
5	GEN	Icajin ~	35.95	1.127	-3.065	-1.221
6	GEN	Iride	45.52	0.4743	-0.5754	1.937
7	GEN	MVTD15-~	40.2	-1.671	0.8598	-0.8499
8	GEN	MVTD20-~	37.63	1.414	1.453	-1.168
9	GEN	Mv-Maka~	36.83	-1.016	1.756	0.2601
10	GEN	Mv-Pels~	44.53	-0.07954	0.9482	0.6419
11	GEN	Mv-Veka~	38.48	-1.801	-0.2634	0.1775
12	GEN	Saragol~	43.48	1.241	0.3673	0.7176
13	GEN	Sebatel~	45.07	2.176	-0.2345	-0.9007
14	GEN	Senator~	32.94	1.385	0.1260	-0.06213
15	GEN	Vulci	35.23	-2.890	-0.4943	-1.172
16	ENV	IT2019	37.67	3.154	2.904	0.4845
17	ENV	IT2020	46.58	-1.314	-0.03165	-3.065
18	ENV	IT2021	34.31	-3.846	0.5878	1.834
19	ENV	IT2022	44.98	2.006	-3.460	0.7462

B

	type	Code	Y	PC1	PC2	PC3
	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<dbl>
1	GEN	Azeghar~	12.92	0.1495	0.5795	0.1696
2	GEN	Fuego	13.34	-0.2207	-0.5509	0.7988
3	GEN	Gibralt~	13.12	0.06884	-0.07195	-0.4908
4	GEN	HFN 94n	12.96	0.3675	0.4193	-0.1460
5	GEN	Icajin ~	13.92	0.7950	-0.009473	0.6827
6	GEN	Iride	13.64	0.9786	-0.9842	-0.4754
7	GEN	MVTD15-~	14.75	-1.569	-0.1538	0.03134
8	GEN	MVTD20-~	13.85	-0.3718	-0.1220	-0.08777
9	GEN	Mv-Maka~	13.49	-0.6939	0.3277	-0.2714
10	GEN	Mv-Pels~	12.99	-0.1434	-0.1023	-0.1560
11	GEN	Mv-Veka~	13.27	0.2496	0.2302	-0.4878
12	GEN	Saragol~	13.31	0.02846	0.3423	0.02997
13	GEN	Sebatel~	14.39	0.7059	0.4246	0.1189
14	GEN	Senator~	14.61	0.03393	0.1159	0.2697
15	GEN	Vulci	14.61	-0.3783	-0.4449	0.01430
16	ENV	IT2019	11.47	1.332	-0.8464	-0.5516
17	ENV	IT2020	12.8	-0.2340	-0.3685	1.187
18	ENV	IT2021	12.91	0.7120	1.285	-0.05448
19	ENV	IT2022	17.53	-1.810	-0.06971	-0.5809

Figure S3. Additive main effects and multiplicative interaction (AMMI 1) biplots show GEI of the 15 durum wheat varieties under 4 environments for **A** – grain yield (GY), and **B** – protein content (PROT).

Table S3. The total Private alleles.

Locus	Trait	Allele	Frequency	Found in
Barc170	GPC	164	0.5	Azeghar
Barc170	GPC	102	0.5	Azeghar
xgwm18	LEAF RUST	164	0.5	Azeghar
xgwm18	LEAF RUST	102	0.5	Azeghar
Xgwm408	Flowering time	168	1	Azeghar
XGWM637	Root angle	175	1	Azeghar
barc117	GPC - TKW	220	1	Fuego
XGWM636	primary root length	115	1	Fuego
Barc147	GPC - TKW	136	1	Gibraltar
Barc170	GPC	194	0.5	Gibraltar
WMS493	GPC - GY	161	0.5	Gibraltar
Xcfa2086	Heading day	269	1	Gibraltar
xgwm18	LEAF RUST	194	0.5	Gibraltar
XGWM234A	ROOT ANGLE - Dough strenght	216	1	Gibraltar
XGWM285	Pyrenophora tritici-repentis (Died.)	220	1	Gibraltar
XGWM427	Root angle	228	1	Gibraltar
XGWM637	Root angle	158	1	Gibraltar
WMS493	GPC - GY	185	0.5	Icajin
WMS5	Root angle	171	1	Icajin
XCFA2257	total seminal root length	160	1	Icajin
XCFD50	Shoot length	1	1	Icajin
XGWM332	Shoot length	206	0.5	Icajin
Xgwm408	Flowering time	196	1	Icajin
XGWM637	Root angle	183	1	Icajin

XWMC505	Shoot length	143	1	Icajin
xwmc75	POWDERY MILDEW	320	0.5	Iride
xwmc75	POWDERY MILDEW	185	0.5	Iride
WMS493	GPC - GY	213	1	Makaroni
xgwm155	Shoot length	144	1	Makaroni
xgwm282	FUSARIUM	1	1	Makaroni
xwmc75	POWDERY MILDEW	267	0.5	Makaroni
Barc170	GPC	179	0.5	MVTD1519
Barc3402	LEAF RUST	232	1	MVTD1519
xgwm18	LEAF RUST	179	0.5	MVTD1519
XGWM234B	ROOT ANGLE - Dough strenght	271	1	MVTD1519
XGWM427	Root angle	247	1	MVTD1519
XWMC727	primary root length	227	0.5	MVTD1519
xgwm155	Shoot length	439	0.5	MVTD2019
XGWM46	shoot length - Heading day	190	1	MVTD2019
XBARC133	FUSARIUM	98	1	MvVekadur
XCFA2257	total seminal root length	220	0.5	MvVekadur
xgwm282	FUSARIUM	188	1	MvVekadur
XGWM285	Pyrenophora tritici-repentis (Died.)	248	1	MvVekadur
XGWM332	Shoot length	217	0.5	MvVekadur
XGWM332	Shoot length	200	0.5	MvVekadur
Xgwm408	Flowering time	169	1	MvVekadur
XGWM637	Root angle	166	1	MvVekadur
WMS493	GPC - GY	154	1	Pelsodur
XGWM46	shoot length - Heading day	260	1	Pelsodur
XGWM636	primary root length	131	1	Pelsodur
XWMC727	primary root length	1	0.5	Pelsodur

Barc3402	LEAF RUST	231	1	Saragolla
WMS5	Root angle	185	1	S.Cappelli
Xcfa2086	Heading day	275	1	S.Cappelli
XGWM285	Pyrenophora tritici-repentis (Died.)	238	1	S.Cappelli
XGWM637	Root angle	180	1	S.Cappelli
xgwm282	FUSARIUM	216	1	Sebatel
XGWM637	Root angle	174	1	Sebatel
Barc3402	LEAF RUST	228	1	Vulci
xgwm282	FUSARIUM	171	0.5	Vulci
xgwm282	FUSARIUM	155	0.5	Vulci
XGWM332	Shoot length	282	0.5	Vulci
XGWM637	Root angle	191	1	Vulci

Table S4. The Private alleles for six selected genotypes.

Locus	**Trait**	**Allele**	**Frequency**	**Found in**
barc117	GPC - TKW	220	1	Fuego
XGWM636	primary root length	115	1	Fuego
WMS493	GPC - GY	185	0.5	Icajin
WMS5	Root angle	171	1	Icajin
XCFA2257	total seminal root length	160	1	Icajin
XCFD50	Shoot length	1	1	Icajin
XGWM332	Shoot length	206	0.5	Icajin
Xgwm408	Flowering time	196	1	Icajin
XGWM637	Root angle	183	1	Icajin
XWMC505	Shoot length	143	1	Icajin
xwmc75	POWDERY MILDEW	320	0.5	Iride
xwmc75	POWDERY MILDEW	185	0.5	Iride
WMS493	GPC - GY	154	1	Pelsodur
XGWM46	shoot length - Heading Day	260	1	Pelsodur
XGWM636	primary root length	131	1	Pelsodur
XWMC727	primary root length	1	0.5	Pelsodur
WMS5	Root angle	185	1	S.Cappelli
Xcfa2086	Heading day	275	1	S.Cappelli
XGWM285	*Pyrenophora tritici-repentis* (Died.)	238	1	S.Cappelli
XGWM637	Root angle	180	1	S.Cappelli
xgwm282	FUSARIUM	171	0.5	Vulci
xgwm282	FUSARIUM	155	0.5	Vulci
XGWM332	Shoot length	282	0.5	Vulci
XGWM637	Root angle	191	1	Vulci
Barc3402	LEAF RUST	228	1	Vulci

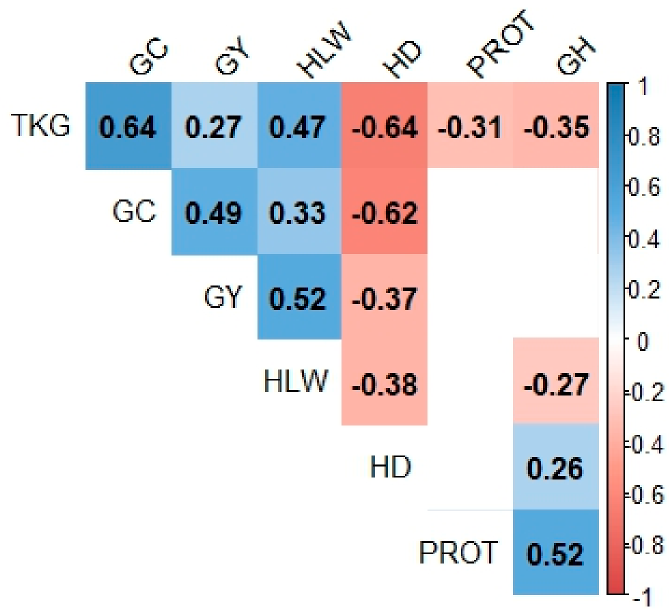

Figure S4. Positive significant correlation (in blue) and negative significant correlation (in red) among all traits. The grain yield (GY), test weight (HLW), protein content (PROT), thousand kernel weight (TKG), the heading day (HD), ground cover (GC), and growth habit (GH).