Article

Allelic Variants of Glutamine Synthetase and Glutamate Synthase Genes in a Collection of Durum Wheat and the Association with Grain Protein Content

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Supplementary Table1. Genome specific primer combination for *GS2* genes

Primer Name	Primer Sequences		Annealing Temperature (℃)
	Forward (5'-3')	Reverse (5'-3')	
GS2_A-a	ACAAACGGAATCTGACTTT	TAAAACTTCCACCCTTCCC	55
GS2_A-b	TAGATTATATGAACCTTTTCA	CGCTCACGATCGGAGCTGAAC	58
GS2_A-c	GGATCGACTTCTGCGACGTCC	CAGCCCAAGCGACCTCTC	55
GS2_A-d	CGGTGCAGTGCAGGTCTTGC	CCGAGGGCCAGCACCTTGAAG	60
GS2_A-e	CCGCGGGCAGGGTGTGGGGC	GGACGCGCTATATTTTGG	55
GS2_A-f	TAGCGTGATGGTCATCACAGT	CATGTAACCAGTAAAAG	58
GS2_A-g	CATCTGGACGTGCTTTATGC	CTCCCACTGCATGAATAC	55
GS2_B-a	ATACTGTTCACCTGTGACTC	CGGGACGGCCGACCTGCCCC	55
GS2_B-b	CAGCTAGCGCTGAAGGGGAA	GATGAGCATGAAGATATGGG	58
GS2_B-c	AACAAATCTGACCATTTCGC	CAGAGTGTACTCCTGTTCGA	60
GS2_B-d	ACACATGGCTGCACAAATCT	CATAAACTCATAGCACATGC	55
GS2_B-e	GATGGCCTGATATCACAGTG	GGTTTATCACTTGCAAATTA	55
GS2_B-f	AAATACTAAGTGAAAATATT	AACACATAGGTGACAGCAGA	57
GS2_B-g	CTCTATTCGTGTGGGGCGAG	CCGAATGGACTCAGGTACAG	59

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11   Supplementary Table 2 Genome specific primer combination for *GOGAT* genes.

Primer Name	Primer Sequences		Annealing Temperature (℃)
	Forward (5'-3')	Reverse (5'-3')	
Fd-GOGAT_A-a	ACAAACGGAATCTGACTTT	TAAAACTTCCACCCTTCCC	55
Fd-GOGAT_A-b	TAGATTATATGAACCTTTTCA	CGCTCACGATCGGAGCTGAAC	58
Fd-GOGAT_A-c	GGATCGACTTCTGCGACGTCC	CAGCCCAAGCGACCTCTC	55
Fd-GOGAT_A-d	CGGTGCAGTGCAGGTCTTGC	CCGAGGGCCAGCACCTTGAAG	60
Fd-GOGAT_A-e	CCGCGGGCAGGGTGTGGGGC	GGACGCGCTATATTTTGG	55
Fd-GOGAT_A-f	TAGCGTGATGGTCATCACAGT	CATGTAACCAGTAAAAG	58
Fd-GOGAT_A-g	CATCTGGACGTGCTTTATGC	CTCCCACTGCATGAATAC	55
Fd-GOGAT_A-h	ACAAACGGAATCTGACTTT	TAAAACTTCCACCCTTCCC	55
Fd-GOGAT_A-i	TAGATTATATGAACCTTTTCA	CGCTCACGATCGGAGCTGAAC	58
Fd-GOGAT_A-l	GGATCGACTTCTGCGACGTCC	CAGCCCAAGCGACCTCTC	55
Fd-GOGAT_A-m	CGGTGCAGTGCAGGTCTTGC	CCGAGGGCCAGCACCTTGAAG	60
Fd-GOGAT_A-n	CCGCGGGCAGGGTGTGGGGC	GGACGCGCTATATTTTGG	55
Fd-GOGAT_A-o	TAGCGTGATGGTCATCACAGT	CATGTAACCAGTAAAAG	58
Fd-GOGAT_A-p	CATCTGGACGTGCTTTATGC	CTCCCACTGCATGAATAC	55
Fd-GOGAT_B-a	GCTGCGGATTTGAACCAT	GTTCATTCTGAAGGTACTT	52
Fd-GOGAT_B-b	TCTTGGGCAGTTCTCTAA	ACCTCCGGGTATTTTAGTA	50
Fd-GOGAT_B-c	AAGAACCATCCGACATTCTT	TTTCCAATAGCGTGCTCGA	58
Fd-GOGAT_B-d	CTTGATCGAAATGGGCTGAGT	GTTATCATCATTCCAGGAGCT	58
Fd-GOGAT_B-e	GTAGTAATGAAAGGAAGACTA	ACGGCTAATGGAATGTCGTCA	50
Fd-GOGAT_B-f	CCAACATTTTGCATGCGTG	AGAAGTTGAGAACCACTTCT	55
Fd-GOGAT_B-g	AGCTGATGCTGCTGTGAGA	TGAAACACTGAGCAGTGACG	58
Fd-GOGAT_B-h	TGTCAGCTTCAATTGTTACC	TTTTGTTGCTCAGCCTCGAC	56
Fd-GOGAT_B-i	CATTGGAAACATGCCGGTAG	GCAGCTTTGACATCTCAGGAATG	61
Fd-GOGAT_B-l	AGGTGAATTTCATGCAAAC	AATTGGCTACAAACAAGTTC	52
Fd-GOGAT_B-m	TCTTGCAGATGAACTTGTT	CTGAATTACGTCTGCACTG	52
Fd-GOGAT_B-n	TGGAACTGTAGCCTCTAGG	AATTGGGCTAGCTCCACTA	53
Fd-GOGAT_B-o	ATATCAGGTCATGATGGTAGT	GATCTGCAAGGATTGTCACG	54
Fd-GOGAT_B-p	GAGACAATCCTTGCAGATGCT	TCTTCATCTAGCATGTAGACC	55

Primer name	Primer sequences		Annealing temperature (℃)
	Forward (5'-3')	Reverse (5'-3')	
NADH-GOGAT_A-a	CCGCTGTTGATTTTCTCT	GGCCCGGATAGATACAATTG	55
NADH-GOGAT_A-b	TCTCGACACTGAACCAGCG	GTGGAGAACCTTGAGTGAACC	58
NADH-GOGAT_A-c	AGGAAGTTCTGTTTTGAACAC	TTTACCAATTTTCATCACCAAA	60
NADH-GOGAT_A-d	TTGTTTGATAGTCAATTGTATC	GATAGCATCAAAATAAGTAGTG	60
NADH-GOGAT_A-e	TATTTTTGCCCTAGTAGTCTG	ACCAGTTTAGCAAGTGATTCT	58
NADH-GOGAT_A-f	CTTGCTAAACTGGTATAATG	AACCCTCTTATAATCCCTT	55
NADH-GOGAT_A-g	ATACTCTCTAAATTTGAAAG	TTAGTTACCTTGGTTTTGT	57
NADH-GOGAT_A-h	TGTTGGGAGTGATCCTATG	TCCATTACCCAGACGACT	54
NADH-GOGAT_B-a	CTTTCTGTTGTTGATTTTCTGC	GGCCCGGATAGATACAATTG	58
NADH-GOGAT_B-b	GCTCGATACTGAACCAGCC	GTGGAGAACCTTGAGTGAACC	56
NADH-GOGAT_B-c	CAAGGAAGTTTTGTTTTGAAAAT	TTTACCAATTTTCATCACCAAA	60
NADH-GOGAT_B-d	TGTTTGATAGTCAATTGTCTG	GATAGCATCAAAATAAGTAGTG	55
NADH-GOGAT_B-e	TATTTTTGCTGCAGTAGTATA	ACCAGTTTAGCAAGTGATTCT	60
NADH-GOGAT_B-f	CTTGCTAAACTGGTACAAGT	AACCCTCTTATAATCCCTT	58
NADH-GOGAT_B-g	ATACTCTCTAAATTCGATAC	TTAGTTACCTTGGTTTTGT	55
NADH-GOGAT_B-h	TGTAGGGAGTGATCCTCTA	TCCATATTACCCAGACGACT	60

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14 Supplementary Table 3 List of tetraploid accession used in the study

Genotype	Taxonomic Classification (Slageren 1994)
5-BIL42	subsp. *durum*
AC Navigator	subsp. *durum*
Adamello	subsp. *durum*
Agridur	subsp. *durum*
Alemanno	subsp. *durum*
Altar84	subsp. *durum*
Ambral	subsp. *durum*
Ancomarzio	subsp. *durum*
Antas	subsp. *durum*
Appio	subsp. *durum*
Appulo	subsp. *durum*
Arcangelo	subsp. *durum*
Arcobaleno	subsp. *durum*
Ares	subsp. *durum*
Arnacoris	subsp. *durum*
Athena	subsp. *durum*
Aziziah	subsp. *durum*
Barcarol	subsp. *durum*
Belfuggito	subsp. *durum*
Berillo	subsp. *durum*
Brindur	subsp. *durum*
Cannizzo	subsp. *durum*
Canyon	subsp. *durum*
Capeiti-8	subsp. *durum*
Cappelli	subsp. *durum*
Casanova	subsp. *durum*
Ceedur	subsp. *durum*
Chiara	subsp. *durum*
Ciccio	subsp. *durum*
Ciclope	subsp. *durum*
Cirillo	subsp. *durum*
Claudio	subsp. *durum*
Colosseo	subsp. *durum*
Cosmodur	subsp. *durum*
Creso	subsp. *durum*
Dauno	subsp. *durum*
Doral	subsp. *durum*
Duetto	subsp. *durum*
Duilio	subsp. *durum*
Durfort	subsp. *durum*

Dylan	subsp. *durum*
Enduro	subsp. *durum*
Exeldur	subsp. *durum*
Fauno	subsp. *durum*
Fenix	subsp. *durum*
Fiore	subsp. *durum*
Fortore	subsp. *durum*
Gianni	subsp. *durum*
Giotto	subsp. *durum*
Granizo	subsp. *durum*
Grazia	subsp. *durum*
Grecale	subsp. *durum*
Grifoni	subsp. *durum*
Hymera	subsp. *durum*
Imhotep	subsp. *durum*
Iride	subsp. *durum*
Isa	subsp. *durum*
Italo	subsp. *durum*
K26	subsp. *durum*
Karel	subsp. *durum*
Kiperounda	subsp. *durum*
Kronos	subsp. *durum*
L092	subsp. *durum*
L252	subsp. *durum*
Lambro	subsp. *durum*
Langdon	subsp. *durum*
Latino	subsp. *durum*
Latinur	subsp. *durum*
Lloyd	subsp. *durum*
Maestrale	subsp. *durum*
Meridiano	subsp. *durum*
Messapia	subsp. *durum*
Mexicali 75	subsp. *durum*
Mida	subsp. *durum*
Nefer	subsp. *durum*
Neodur	subsp. *durum*
Neolatino	subsp. *durum*
Normanno	subsp. *durum*
Ofanto	subsp. *durum*
Orfeo	subsp. *durum*
Martino	subsp. *durum*
Orobel	subsp. *durum*
Parsifal	subsp. *durum*
Pedroso	subsp. *durum*
Platani	subsp. *durum*

Plinio	subsp. *durum*
Polesine	subsp. *durum*
PR22D89	subsp. *durum*
Preco	subsp. *durum*
Primadur	subsp. *durum*
Produra	subsp. *durum*
Provenzal	subsp. *durum*
Quadruro	subsp. *durum*
Quadrato	subsp. *durum*
Russello	subsp. *durum*
Rusticano	subsp. *durum*
S99b34	subsp. *durum*
Saadi	subsp. *durum*
Amedeo	subsp. *durum*
San Carlo	subsp. *durum*
Avispa	subsp. *durum*
Sansone	subsp. *durum*
Saragolla	subsp. *durum*
Sharm 5	subsp. *durum*
Simeto	subsp. *durum*
Strongfield	subsp. *durum*
Svevo	subsp. *durum*
Taganrog	subsp. *durum*
Timilia	subsp. *durum*
Tito	subsp. *durum*
Tiziana	subsp. *durum*
Tresor	subsp. *durum*
Trinakria	subsp. *durum*
UC1113	subsp. *durum*
Valforte	subsp. *durum*
Valgerardo	subsp. *durum*
Valnova	subsp. *durum*
Varano	subsp. *durum*
Vendetta	subsp. *durum*
Vesuvio	subsp. *durum*
Bronte	subsp. *durum*
Virgilio	subsp. *durum*
Vitromax	subsp. *durum*
West Bread 881	subsp. *durum*
Zenit	subsp. *durum*
Kamut	subsp. *turanicum*
Cltr 11390	subsp. *turanicum*
PI 68287	subsp. *turanicum*
PI 113393	subsp. *turanicum*
PI 167481	subsp. *turanicum*

PI 191599	subsp. *turanicum*
PI 192641	subsp. *turanicum*
PI 254206	subsp. *turanicum*
PI 278350	subsp. *turanicum*
PI 290530	subsp. *turanicum*
PI 306665	subsp. *turanicum*
PI 576854	subsp. *turanicum*
PI 623656	subsp. *turanicum*
PI 624429	subsp. *turanicum*
PI 127106	subsp. *turanicum*
PI 67343	subsp. *turanicum*
PI 192658	subsp. *turanicum*
PI 184526	subsp. *turanicum*
PI 352514	subsp. *turanicum*
PI 362067	subsp. *turanicum*
PI 210845	subsp. *polonicum*
PI 223171	subsp. *polonicum*
PI 266846	subsp. *polonicum*
PI 272564	subsp. *polonicum*
PI 278647	subsp. *polonicum*
PI 286547	subsp. *polonicum*
PI 289606	subsp. *polonicum*
PI 290512	subsp. *polonicum*
PI 306549	subsp. *polonicum*
PI 330554	subsp. *polonicum*
PI 330555	subsp. *polonicum*
PI 349051	subsp. *polonicum*
PI 352487	subsp. *polonicum*
PI 352488	subsp. *polonicum*
PI 352489	subsp. *polonicum*
PI 361757	subsp. *polonicum*
PI 366117	subsp. *polonicum*
PI 387479	subsp. *polonicum*
PI 566593	subsp. *polonicum*
208911	subsp. *polonicum*
Baio	subsp. *durum*
PI 56263	subsp. *turgidum*
PI 134946	subsp. *turgidum*
PI 157983	subsp. *turgidum*
PI 157985	subsp. *turgidum*
PI 173503	subsp. *turgidum*
PI 185723	subsp. *turgidum*
PI 191104	subsp. *turgidum*
PI 191145	subsp. *turgidum*
PI 191203	subsp. *turgidum*

PI 286075	subsp. *turgidum*
PI 221423	subsp. *turgidum*
PI 352544	subsp. *turgidum*
PI 290522	subsp. *turgidum*
PI 290526	subsp. *turgidum*
PI 341391	subsp. *turgidum*
PI 352538	subsp. *turgidum*
PI 352541	subsp. *turgidum*
PI 352542	subsp. *turgidum*
PI 352543	subsp. *turgidum*
Citr 7665	subsp. *carthlicum*
PI 70738	subsp. *carthlicum*
PI 94755	subsp. *carthlicum*
PI 115816	subsp. *carthlicum*
PI 283888	subsp. *carthlicum*
PI 341800	subsp. *carthlicum*
PI 499972	subsp. *carthlicum*
PI 532501	subsp. *carthlicum*
PI 572849	subsp. *carthlicum*
PI 573182	subsp. *carthlicum*
PI 585017	subsp. *carthlicum*
PI 585018	subsp. *carthlicum*
MG3521	subsp. *dicoccum*
MG5323	subsp. *dicoccum*
MG5473	subsp. *dicoccum*
Farvento	subsp. *dicoccum*
Lucanica	subsp. *dicoccum*
MG 5350	subsp. *dicoccum*
MG 4387	subsp. *dicoccum*
MG 5416/1	subsp. *dicoccum*
MG5471/1	subsp. *dicoccum*
MG15516/1	subsp. *dicoccum*
MG5344/1	subsp. *dicoccum*
MG5300/1	subsp. *dicoccum*
MG5293/1	subsp. *dicoccum*
MG29704	subsp. *dicoccum*
Molise Sel. Colli	subsp. *dicoccum*
ISC_Foggia_152	subsp. *dicoccum*
ISC_Foggia_159	subsp. *dicoccum*
ISC_Foggia_161	subsp. *dicoccum*
ISC_Foggia_171	subsp. *dicoccum*
ISC_Foggia_175	subsp. *dicoccum*
MG 4343	subsp. *dicoccoides*
MG29896	subsp. *dicoccoides*
PC32	subsp. *durum*

MG4337/198	subsp. *dicoccoides*
MG4328/61	subsp. *dicoccoides*
MG5444/235	subsp. *dicoccoides*
MG4330/66	subsp. *dicoccoides*
PI 343446	subsp. *dicoccoides*
PI 346783	subsp. *dicoccoides*
PI 481539	subsp. *dicoccoides*
PI 352323	subsp. *dicoccoides*
PI 352324	subsp. *dicoccoides*
PI 355459	subsp. *dicoccoides*
PI 428145	subsp. *dicoccoides*
PI 352332	subsp. *dicoccoides*
PI 467029	subsp. *dicoccoides*
PI 470944	subsp. *dicoccoides*
PI 470945	subsp. *dicoccoides*
Ariosto	subsp. *durum*

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