

Supplemental Table 1. High yielding japonica varieties used in this study

Cultivars	Origin	Subspecies	Released decades
Baimaodao	Heilongjiang	<i>Japonica</i>	1970-1979
Hejiang15	Heilongjiang	<i>Japonica</i>	1970-1979
Hejiang19	Heilongjiang	<i>Japonica</i>	1970-1979
Dongnong415	Heilongjiang	<i>Japonica</i>	1980-1989
Hejiang20	Heilongjiang	<i>Japonica</i>	1980-1989
Hejiang21	Heilongjiang	<i>Japonica</i>	1980-1989
Kendao2	Heilongjiang	<i>Japonica</i>	1980-1989
Dongnong419	Heilongjiang	<i>Japonica</i>	1990-1999
Kendao10	Heilongjiang	<i>Japonica</i>	1990-1999
Kendao11	Heilongjiang	<i>Japonica</i>	1990-1999
Kendao8	Heilongjiang	<i>Japonica</i>	1990-1999
Longjing8	Heilongjiang	<i>Japonica</i>	1990-1999
Dongnong425	Heilongjiang	<i>Japonica</i>	2000-2009
Longdao3	Heilongjiang	<i>Japonica</i>	2000-2009
Longdao5	Heilongjiang	<i>Japonica</i>	2000-2009
Longjing13	Heilongjiang	<i>Japonica</i>	2000-2009
Longjing14	Heilongjiang	<i>Japonica</i>	2000-2009
Longjing31	Heilongjiang	<i>Japonica</i>	2000-2009
Songjing9	Heilongjiang	<i>Japonica</i>	2000-2009
Jijing53	Jilin	<i>Japonica</i>	1970-1979
Jijing56	Jilin	<i>Japonica</i>	1970-1979
Jijing60	Jilin	<i>Japonica</i>	1970-1979
Guandong107	Jilin	<i>Japonica</i>	1980-1989
Jijing62	Jilin	<i>Japonica</i>	1980-1989
Jijing63	Jilin	<i>Japonica</i>	1980-1989
Xingguo	Jilin	<i>Japonica</i>	1980-1989
Changbai9	Jilin	<i>Japonica</i>	1990-1999
Chaochan1	Jilin	<i>Japonica</i>	1990-1999
Jijing67	Jilin	<i>Japonica</i>	1990-1999
Jiyujing	Jilin	<i>Japonica</i>	1990-1999
Changbai13	Jilin	<i>Japonica</i>	2000-2009
Ji2813	Jilin	<i>Japonica</i>	2000-2009
Jijing105	Jilin	<i>Japonica</i>	2000-2009
Jijing95	Jilin	<i>Japonica</i>	2000-2009
Yanjing23	Jilin	<i>Japonica</i>	2000-2009
Hanfeng	Liaoning	<i>Japonica</i>	1970-1979
Liaojing5	Liaoning	<i>Japonica</i>	1980-1989
Liaojing294	Liaoning	<i>Japonica</i>	1990-1999
Liaojing371	Liaoning	<i>Japonica</i>	1990-1999
Liaojing454	Liaoning	<i>Japonica</i>	1990-1999
Liaojing9	Liaoning	<i>Japonica</i>	1990-1999
Liaoyan2	Liaoning	<i>Japonica</i>	1990-1999

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Tiejing2	Liaoning	<i>Japonica</i>	1990-1999
Changlixingzhilisui	Liaoning	<i>Japonica</i>	2000-2009
Huadan995	Liaoning	<i>Japonica</i>	2000-2009
Liaoxing1	Liaoning	<i>Japonica</i>	2000-2009
Liaoxing16	Liaoning	<i>Japonica</i>	2000-2009
Liaoxing17	Liaoning	<i>Japonica</i>	2000-2009
Qianchonglang2	Liaoning	<i>Japonica</i>	2000-2009
Shendao29	Liaoning	<i>Japonica</i>	2000-2009
Shendao3	Liaoning	<i>Japonica</i>	2000-2009
Shendao6	Liaoning	<i>Japonica</i>	2000-2009
Shendao9	Liaoning	<i>Japonica</i>	2000-2009
Shenjing4311	Liaoning	<i>Japonica</i>	2000-2009
Shennong265	Liaoning	<i>Japonica</i>	2000-2009
Shennong606	Liaoning	<i>Japonica</i>	2000-2009
Shennong9741	Liaoning	<i>Japonica</i>	2000-2009
Yanfeng47	Liaoning	<i>Japonica</i>	2000-2009
Nipponbare	Japan	<i>Japonica</i>	1950-1959
Chuxing	Japan	<i>Japonica</i>	1970-1979
Fengjin	Japan	<i>Japonica</i>	1970-1979
Qiuguang	Japan	<i>Japonica</i>	1970-1979
Xindai	Japan	<i>Japonica</i>	1980-1989
Yimuhu	Japan	<i>Japonica</i>	1980-1989
Kongyu131	Japan	<i>Japonica</i>	1990-1999
Qiutianxiaoding	Japan	<i>Japonica</i>	1990-1999
Huachuilei	Japan	<i>Japonica</i>	
Huaxiang	Japan	<i>Japonica</i>	
Lige	Japan	<i>Japonica</i>	
Muyu	Japan	<i>Japonica</i>	
Wuji	Japan	<i>Japonica</i>	
Yanshouchuanshou	Japan	<i>Japonica</i>	

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Supplemental Table 2. Primer sequences for sequencing the *DEP1* locus

	Forward primer (5'-3')	Reverse primer (5'-3')
DEP1-1	GAATTCGTCTCTCAGTGAGCCGTTCC	GGATCCTCATGGGCATTATAGCAGCA
DEP1-2	GACAGCGTATCCAACGTAGGCTC	GCAAAGACATGAAATGCAGATACAC
DEP1-3	TTCGTA CTGGTCAATTACTCCAGG	TTGAGGCACCTTGGTCTTTTGA
DEP1-4	AGAGAAGGAGGCACAGATCTTGCC	GCATGAAGGGCAGTAGTACATACTC
DEP1-5	GTCGTAACCCATGCTGTCTCA	TTGGCGAGTAAATGAGTCCAA

Supplemental Table 3. Primer sequences used to analysis the population structure

QTLs	Chromosome	Marker	Forward primer (5'-3')	Reverse primer (5'-3')	
<i>Gn1a</i>	1	Gn1a-M	CTCTTGCTTCATTATCAATC	AAACTACACAAGAATCTGCT	InDel
<i>GW1-1</i>	1	RM10376	TTAGTTTAACCGCACCGTACACC	GGTCGTTGAATTGGTGTC AAGC	SSR
<i>GW1-2</i>	1	RM10404	CTGGAGTGGTTTCTCTCCTCTGC	TACTCTGCTCGCGTAACTTCTCC	SSR
<i>qGRL1</i>	1	RM431	GCTTGCTTGTATCTGCATTGGTAGG	GGGATGATCCACTCTCTGTTTGG	SSR
<i>SPP1</i>	1	YN37	GACCTCCCTCCTATCGTAATGA	CAAGGAGGGAAGGACAACAA	InDel
<i>GW2</i>	2	GW2	CCAATAAAGATGTCCATTCTGTTA	GCTCTTCCTGTAACACATATTATG	dCaps ( <i>Hpa</i> I )
<i>LGS1</i>	2	RM13838	CCCAACTGCTAGGTTTCTGATCC	ACTGTGTTACTGTGTGCCGTTGC	SSR
<i>qGY2-1</i>	2	RM279	GCGGGAGAGGGATCTCCT	GGCTAGGAGTTAACCTCGCG	SSR
<i>qSPP2</i>	2	MRG2762	CATGCTAGTAAGCAAAGGGCAACG	TTGCACGTCCAAGTCCAAGC	SSR
<i>Quality</i>	2	RM3515	CATGCTAGTAAGCAAAGGGCAACG	TTGCACGTCCAAGTCCAAGC	SSR
<i>Quality</i>	2	RM5470	CGTGTATTGCATGGATTGTCTGG	CGGAACCCACAATTTCTTTCTGC	SSR
<i>GS3</i>	3	GS3	TATTTATTGGCTTGATTCCTGTG	GCTGGTTTTTTACTTTCATTTGCC	Caps ( <i>Pst</i> I )
<i>GW3</i>	3	WGW19	ACCAAAATGGAATACCGAACG	TAACAACACGCAATAGAAGG	InDel
<i>gw3.1</i>	3	RM640	GGGTACAACGAGAGGGATGA	CAGCCAGCATAATTTAGCC	SSR
<i>qGL3-1</i>	3	BM14	CAACGTAGGGAGGAGGAC	GAGAGGAGAGTGTGGCATT	InDel
<i>qTGW3-1</i>	3	RM5477	GCACGCATTGTTTCGTGATAGG	GAACCGAACGCAAAGCTAATACC	SSR
<i>Quality</i>	3	RM523	TGAATTCTTGACATGGTCAGC	TGGGAGGTTTGCTAGGGTAATCC	SSR
<i>Quality</i>	3	RM60	CAAGTTCACCCGCCTTCTCG	TTCCATCATTAGCAGGCAGTAGC	SSR
<i>Quality</i>	3	RM6349	ATGATGCCTCATGTCTCTGATCTCC	AGATGAACACGACCGATAGGATAGG	SSR
<i>GIF1</i>	4	SSR1	GAGAGGGGAATCAACATACAC	GACATACCTAGCTCTGAACGAATT	SSR
<i>qGL4b</i>	4	RM1165	CTAGGACGAAGGGGAAGGAC	ACCACCACCATCCAAACTC	SSR
<i>Chalk5</i>	5	C35	GTTTGCATCTCTCTTTGCTG	CAAGAGGAACTCATCTGTAG	InDel
<i>GS5</i>	5	C62	GATTGACTGATAAATTGACAGC	CTAACTCCCATGGAATTAC	InDel

<i>GS5</i>	5	RM574	AAACTAGCCACGGTTTGGTAGGG	AGGGTGGCAGGGATGTAATTTCC	SSR
<i>gw5</i>	5	Indel1	AGTACGACCATGATGTTTCCC	GACCTAACCCATCTCATTCCA	InDel
<i>qSW5</i>	5	qSW5	CGTCTTGCAACCAACGCCGATGTTA T	GAGCGTGTGTAGGGAAGGAGCTGCATGA	InDel
<i>SGL</i>	5	D6	CGAAAGAAACCAAGGC	CTATTATTGGCACAAGGAA	InDel
<i>srs3</i>	5	3151	TTTTGTGGTCCCCTGATTCAG	CCTCCACTTAGCACCGTGCT	InDel
<i>Quality</i>	5	RM3575	ACAGCCTCAAATTGTGAGCAAGG	GCTGTATGATCTGTATCCATCCATCC	SSR
<i>GW6</i>	6	RM7179	CACGTGTCAGCTTAAGAGCG	TTACATCATAAGCCCGCAGG	SSR
<i>gw6a</i>	6	xj-6	AGCCAAGAAGCAAGAACTCA	ACCTCAACCTGTGCTCAA	InDel
<i>qSPP6</i>	6	RM20521	CAGTCTTGATTGCAGCTGTACC	AGTCTGCTGTCTGATGTCAACC	SSR
<i>tgw6</i>	6	InDel-1	GAGAAAGTGACCCTCGTTTAGT	CAAGACATGACACTACGATTGC	InDel
<i>TGW6</i>	6	TGW6	CCACAGCCACAACGAGAAT	ACCGTTCGGGTAGGTTATGT	Caps( <i>BssHII</i> )
<i>Ur1</i>	6	SSR17	CCCTTGCTAAGCTAGCCC	CAGCGAATGTACGAAGAAGC	SSR
<i>Quality</i>	6	RM1161	CTTTGCAAACCTGCCATCCAATCC	GATGGGCAAGGAGGCTGGTAGC	SSR
<i>Quality</i>	6	RM1369	CATCGATTAGCTTACATGGCAACG	ACTAGTGCAGCCGTCTTCAATGG	SSR
<i>Quality</i>	6	RM19660	TTTGTCCCTGCCGTACTIONTGC	AGCCACGTTGGGTGAAATTAGC	SSR
<i>Quality</i>	6	RM587	TTCCCATCTGCACTACCATAATCC	GAGCAGAGATGTGCTTTGCTACC	SSR
<i>Quality</i>	6	RM589	GTGGCTTAACCACATGAGAACTAC C	TCACATCATTAGGTGGCAATCG	SSR
<i>Quality</i>	6	RM8101	GTGTAGTTACGACCAATGATACGC	TATAATGAGTTCGAGCCGATCC	SSR
<i>Quality</i>	6	RM8120	TACACGCTAGCTGCTATGACTGC	TTCAACTAGCTAGCCACCTACACC	SSR
<i>BG2</i>	7	S2	CTCCTCCTCCACCGACCA	TAACGTGTGTTGCGTTGC	SSR
<i>gpa7</i>	7	3617	GGATGGATTTGAAGGATTTG	AACCACTTCATTCACCACCC	InDel
<i>GS7</i>	7	FMGS7	ATGGTCAAATCATGGGCTA	TTATTGTGCCTGCGATCC	InDel
<i>qGL7</i>	7	RID76	CACCGAAGACTGATCAGCAA	TCACATTCGAGTGGAGCAAC	InDel
<i>qGL7-2</i>	7	RM21936	ATGCATGTCTGTCTGCACTCTGC	AGATTTCTTGCGCGTCTGAATCC	SSR

<i>qSPP7</i>	7	RM5436	CAAAGGGGGTGTCTCTATG	GTTGCTCGTCCTACATGTGC	SSR
<i>qSS7</i>	7	DGS220	AAATGAGTTTAAGTCGGCTGGA	GGAACGGTTTTGTTGGTTGA	InDel
<i>GW8</i>	8	PSM709	TCACTGATTCCTTTTACgTTT	GCTCAGTTGCTTCTTCATTAGA	InDel
<i>gw8.1</i>	8	RM23211	ACTTGGTCCATCCTGCTGAG	ACCAGTCGCTGTGGTGAAG	SSR
<i>IPA1</i>	8	IPA1	CCAGAAGAGCATCGCAGGTTCA	TGCAGAGCAAGCTCAAGCTCAC	Caps ( <i>sdu I</i> )
<i>qSpp8</i>	8	RM310	GACTTGTGGTTGTTGCTTGTGG	ACTGCCATATGCATTTCCCTAGC	SSR
<i>gw9.1</i>	9	RM24718	GACCAACGTGCATGTGACTT	GCTTGCACTAGGGCTCCT	SSR
<i>Quality</i>	10	RM2887	CGTAGATTGTGGTGGGTCTGTCC	CTTGTTGGAAGCAAATCCCTTTCG	SSR
<i>Quality</i>	12	RM1246	GGCTCACCTCGTTCTCGATCC	CATAAATAAATAGGGCGCCACACC	SSR
<i>Quality</i>	12	RM1300	TTGCTACTACCACAACAGGGTTCC	GCAGCCACAGCTTTGAATAGAGC	SSR
<i>Quality</i>	12	RM2529	GCAACTATTACAGTGACGCTTTGC	GTGAGGCATTCCTGATATGATCG	SSR

Supplemental Table 4. The detail information of the 45 SNPs and 26 indels

Region	Position (bp)	Allele	Type	Frequency (%)	Region	Position (bp)	Allele	Type	Frequency (%)
Promoter	-1983	0bp/1bp	Indel	1.39	Exon 3	2554	G/T	SNP	1.39
Promoter	-1913	G/T	SNP	1.39	Intron 3	2662	0bp/1bp	Indel	1.39
Promoter	-1865	G/C	SNP	1.39	Exon 4	2694	1bp/0bp	Indel	1.39
Promoter	-1302	1bp/0bp	Indel	2.78	Intron 4	2720	T/G	SNP	1.39
Promoter	-1253	C/G	SNP	56.94	Intron 4	2767	C/T	SNP	1.39
Promoter	-1250	1bp/0bp	Indel	1.39	Exon 5	3164	C/A	SNP	1.39
Promoter	-1170	1bp/0bp	Indel	1.39	Exon 5	3177	C/A	SNP	1.39
Promoter	-1066	0bp/1bp	Indel	1.39	Exon 5	3182	C/A	SNP	1.39
Promoter	-1064	0bp/1bp	Indel	1.39	Exon 5	3184	A/G	SNP	2.78
Promoter	-1061	0bp/1bp	Indel	1.39	Exon 5	3183	C/A	SNP	1.39
Promoter	-1058	G/A	SNP	1.39	Exon 5	3240	C/A	SNP	1.39
Promoter	-1052	G/A	SNP	1.39	Exon 5	3246	1bp/0bp	Indel	1.39
Promoter	-960	T/A	SNP	1.39	Exon 5	3249	C/G	SNP	1.39
Promoter	-959	0bp/1bp	Indel	1.39	Exon 5	3273	C/A	SNP	1.39
Promoter	-817	1bp/0bp	Indel	1.39	Exon 5	3285	C/G	SNP	1.39
Promoter	-790	C/A	SNP	1.39	Exon 5	3290	C/G	SNP	1.39
Promoter	-715	1bp/0bp	Indel	1.39	Exon 5	3301	T/A	SNP	1.39
Promoter	-583	A/G	SNP	1.39	Exon 5	3336	T/C	SNP	1.39
Promoter	-582	T/G	SNP	1.39	Exon 5	3363	C/T	SNP	1.39
Promoter	-581	1bp/0bp	Indel	1.39	Exon 5	3423	C/A	SNP	1.39
Promoter	-547	A/G	SNP	1.39	Exon 5	3457	12bp/637bp	Indel	25
Promoter	-526	C/A	SNP	1.39	Exon 5	3473	T/G	SNP	1.39
Promoter	-493	C/G	SNP	1.39	Exon 5	3534	1bp/0bp	Indel	1.39

Promoter	-424	1bp/0bp	Indel	9.72	Exon 5	3551	T/A	SNP	2.78
5'-UTR	-324	C/G	SNP	1.39	Exon 5	3571	1bp/0bp	Indel	1.39
5'-UTR	-200	C/G	SNP	1.39	Exon 5	3574	0bp/1bp	Indel	1.39
5'-UTR	-198	C/G	SNP	1.39	Exon 5	3625	0bp/1bp	Indel	1.39
5'-UTR	-197	T/G	SNP	1.39	Exon 5	3634	0bp/1bp	Indel	1.39
5'-UTR	-181	G/A	SNP	2.78	Exon 5	3682	G/T	SNP	1.39
Exon 1	19	1bp/0bp	Indel	1.39	Exon 5	3711	0bp/1bp	Indel	1.39
Intron 1	278	G/C	SNP	1.39	Exon 5	3838	T/A	SNP	2.78
Intron 1	500	0bp/2bp	Indel	5.56	3'-UTR	4158	T/C	SNP	1.39
Intron 1	564	0bp/1bp	Indel	6.94	3'-UTR	4173	T/C	SNP	2.78
Intron 1	1243	C/A	SNP	1.39	3'-UTR	4222	T/G	SNP	1.39
Intron 1	1268	A/G	SNP	1.39	3'-UTR	4308	C/A	SNP	2.78
Intron 2	1832	0bp/1bp	Indel	9.72					



Supplemental Table 5. Haplotype and protein types of the 72 germplasms used in this study

Cultivars	Origin	Subpop.	G-C alleles	<i>DEP1-dep1</i> alleles	Haplotype	Protein type	Population Structure	
							Q1	Q2
Yanfeng47	Liaoning	Subgroup1	G	<i>dep1</i>	H1	TypeIII	0.567	0.433
Ji2813	Jilin	Subgroup1	G	<i>dep1</i>	H2	TypeIII	0.974	0.026
Changlixingzhilisui	Liaoning	Subgroup1	G	<i>dep1</i>	H2	TypeIII	0.978	0.022
Qianchonglang2	Liaoning	Subgroup1	G	<i>dep1</i>	H2	TypeIII	0.540	0.460
Hejiang15	Heilongjiang	Subgroup1	C	<i>DEP1</i>	H4	Type II	0.966	0.034
Kendao10	Heilongjiang	Subgroup1	C	<i>DEP1</i>	H4	Type II	0.967	0.033
Kendao8	Heilongjiang	Subgroup1	C	<i>DEP1</i>	H4	Type II	0.975	0.025
Longdao3	Heilongjiang	Subgroup1	C	<i>DEP1</i>	H4	Type II	0.942	0.058
Songjing9	Heilongjiang	Subgroup1	C	<i>DEP1</i>	H4	Type II	0.987	0.013
Kongyu131	Japan	Subgroup1	C	<i>DEP1</i>	H4	Type II	0.992	0.008
Nipponbare	Japan	Subgroup1	C	<i>DEP1</i>	H4	Type II	0.723	0.277
Qiuguang	Japan	Subgroup1	C	<i>DEP1</i>	H4	Type II	0.865	0.135
Jijing105	Jilin	Subgroup1	C	<i>DEP1</i>	H4	Type II	0.980	0.020
Jijing56	Jilin	Subgroup1	C	<i>DEP1</i>	H4	Type II	0.965	0.035
Jijing60	Jilin	Subgroup1	C	<i>DEP1</i>	H4	Type II	0.923	0.077
Jijing67	Jilin	Subgroup1	C	<i>DEP1</i>	H4	Type II	0.933	0.067
Jijing95	Jilin	Subgroup1	C	<i>DEP1</i>	H4	Type II	0.967	0.033
Yanjing23	Jilin	Subgroup1	C	<i>DEP1</i>	H4	Type II	0.776	0.224
Hanfeng	Liaoning	Subgroup1	C	<i>DEP1</i>	H4	Type II	0.987	0.013
Tiejing2	Liaoning	Subgroup1	C	<i>DEP1</i>	H4	Type II	0.952	0.048
Xingguo	Jilin	Subgroup1	G	<i>DEP1</i>	H5	Type II	0.990	0.010
Dongnong415	Heilongjiang	Subgroup1	G	<i>DEP1</i>	H6	Type II	0.987	0.013
Dongnong419	Heilongjiang	Subgroup1	G	<i>DEP1</i>	H6	Type II	0.903	0.097
Dongnong425	Heilongjiang	Subgroup1	G	<i>DEP1</i>	H6	Type II	0.987	0.013
Hejiang19	Heilongjiang	Subgroup1	G	<i>DEP1</i>	H6	Type II	0.984	0.016
Hejiang20	Heilongjiang	Subgroup1	G	<i>DEP1</i>	H6	Type II	0.972	0.028
Hejiang21	Heilongjiang	Subgroup1	G	<i>DEP1</i>	H6	Type II	0.990	0.010
Kendao11	Heilongjiang	Subgroup1	G	<i>DEP1</i>	H6	Type II	0.991	0.009
Longdao5	Heilongjiang	Subgroup1	G	<i>DEP1</i>	H6	Type II	0.962	0.038
Longjing13	Heilongjiang	Subgroup1	G	<i>DEP1</i>	H6	Type II	0.984	0.016
Longjing14	Heilongjiang	Subgroup1	G	<i>DEP1</i>	H6	Type II	0.972	0.028
Longjing31	Heilongjiang	Subgroup1	G	<i>DEP1</i>	H6	Type II	0.975	0.025
Changbai13	Jilin	Subgroup1	G	<i>DEP1</i>	H6	Type II	0.956	0.044
Changbai9	Jilin	Subgroup1	G	<i>DEP1</i>	H6	Type II	0.694	0.306
Chaochan1	Jilin	Subgroup1	G	<i>DEP1</i>	H6	Type II	0.974	0.026
Guandong107	Jilin	Subgroup1	G	<i>DEP1</i>	H6	Type II	0.874	0.126
Jijing53	Jilin	Subgroup1	G	<i>DEP1</i>	H6	Type II	0.978	0.022
Jijing62	Jilin	Subgroup1	G	<i>DEP1</i>	H6	Type II	0.937	0.063
Jijing63	Jilin	Subgroup1	G	<i>DEP1</i>	H6	Type II	0.974	0.026

Huadan995	Liaoning	Subgroup2	G	<i>depl</i>	H2	TypeIII	0.048	0.952
Liaojing294	Liaoning	Subgroup2	G	<i>depl</i>	H2	TypeIII	0.015	0.985
Liaojing454	Liaoning	Subgroup2	G	<i>depl</i>	H2	TypeIII	0.150	0.850
Liaojing5	Liaoning	Subgroup2	G	<i>depl</i>	H2	TypeIII	0.175	0.825
Liaojing9	Liaoning	Subgroup2	G	<i>depl</i>	H2	TypeIII	0.052	0.948
Liaoxing1	Liaoning	Subgroup2	G	<i>depl</i>	H2	TypeIII	0.091	0.909
Liaoxing16	Liaoning	Subgroup2	G	<i>depl</i>	H2	TypeIII	0.397	0.603
Liaoxing17	Liaoning	Subgroup2	G	<i>depl</i>	H2	TypeIII	0.363	0.637
Shendao29	Liaoning	Subgroup2	G	<i>depl</i>	H2	TypeIII	0.103	0.897
Shendao3	Liaoning	Subgroup2	G	<i>depl</i>	H2	TypeIII	0.014	0.986
Shendao6	Liaoning	Subgroup2	G	<i>depl</i>	H2	TypeIII	0.008	0.992
Shendao9	Liaoning	Subgroup2	G	<i>depl</i>	H2	TypeIII	0.096	0.904
Shennong265	Liaoning	Subgroup2	G	<i>depl</i>	H2	TypeIII	0.010	0.990
Shennong606	Liaoning	Subgroup2	G	<i>depl</i>	H2	TypeIII	0.072	0.928
Shennong9741	Liaoning	Subgroup2	G	<i>depl</i>	H2	TypeIII	0.020	0.980
Shenjing4311	Liaoning	Subgroup2	C	<i>depl</i>	H3	TypeIII	0.031	0.969
Baimaodao	Heilongjiang	Subgroup2	C	<i>DEP1</i>	H4	Type II	0.250	0.750
Chuxing	Japan	Subgroup2	C	<i>DEP1</i>	H4	Type II	0.033	0.967
Huachuilei	Japan	Subgroup2	C	<i>DEP1</i>	H4	Type II	0.027	0.973
Lige	Japan	Subgroup2	C	<i>DEP1</i>	H4	Type II	0.008	0.992
Muyu	Japan	Subgroup2	C	<i>DEP1</i>	H4	Type II	0.042	0.958
Qiutianxiaoding	Japan	Subgroup2	C	<i>DEP1</i>	H4	Type II	0.010	0.990
Wuji	Japan	Subgroup2	C	<i>DEP1</i>	H4	Type II	0.013	0.987
Xindai	Japan	Subgroup2	G	<i>DEP1</i>	H4	Type II	0.009	0.991
Yanshouchuanshou	Japan	Subgroup2	C	<i>DEP1</i>	H4	Type II	0.009	0.991
Yimuhu	Japan	Subgroup2	C	<i>DEP1</i>	H4	Type II	0.011	0.989
Jiyujing	Jilin	Subgroup2	C	<i>DEP1</i>	H4	Type II	0.258	0.742
Liaoyan2	Liaoning	Subgroup2	C	<i>DEP1</i>	H4	Type II	0.027	0.973
Kendao2	Heilongjiang	Subgroup2	G	<i>DEP1</i>	H6	Type II	0.398	0.602
Longjing8	Heilongjiang	Subgroup2	G	<i>DEP1</i>	H6	Type II	0.335	0.665
Huaxiang	Japan	Subgroup2	G	<i>DEP1</i>	H6	Type II	0.027	0.973
Fengjin	Japan	Subgroup2	C	<i>DEP1</i>	H7	Type I	0.029	0.971
Liaojing371	Liaoning	Subgroup2	C	<i>DEP1</i>	H7	Type I	0.276	0.724

Supplemental Table 6. Physical and chemical properties of type I, type II and type III protein

Protein	Amino acid change				Haplotype	No of aa	Molecular weight	pI	Grain per panicle
	A (102)	A (193-423)	A (225)	A (321)					
I	Cys	231a	His	Ser	7	423	44802	8.36	129.54±12.2a
II	Tyr	231a	Leu	Cys	4, 5, 6	423	44854	8.36	107.55±10.1b
III	Tyr	-	-	-	1, 2, 3	192	21193	8.57	142.55±20.1c

Within a column, data followed by different lowercase letters indicate significant difference at 5% probability levels.

Supplemental Table 7. Descriptive statistics, family mean-basis heritability and percentage of phenotypic variation explained by population structure

Trait	Min	Max	Mean	CV (%)	$H_m^2$	$R^2$
HD (d)	93.0	125.0	105.7	7.7	81.6	52.6
PL (cm)	13.3	28.0	18.4	11.5	97.4	0.7
PBN	7.0	15.0	10.7	19.9	57.7	20.1
SBN	10.2	41.2	21.9	29.7	70.5	4.5
GPP	61.5	194.8	121.6	24.5	56.1	14.2
TGW (g)	19.5	29.4	25.2	8.2	30.8	0.5

$H_m^2$ , Broad-sense heritability on family mean basis

$R^2$ , Percentage of phenotypic variation explained by population structure

HD: Heading date, PL: panicle length, NPB: number of primary branches, NSB: number of secondary branches, GPP: number of grain per panicle, TGW: 1,000 grain weight.