

# Supplemental Data

OsNaPRT1	MAAAAAAANGAGCGVFRPTNFMVTFLLDLYQSMAYAYWKAGKLLRRAVFDFVFRSSFFCGETVFGGLEECRIANFKLDDITTFRISAMPT	99
XP_002466135	V...AAANGDACRSVCS.VFRPTNFMVTFLLDLYQSMAYAYWKAGKLLRRAVFDFVFRSSFFCGETVFGGLEECRIANFKLDDITTFRISAMPT	96
XP_008668392	V...AAANGDACRSVCS.VFRPTNFMVTFLLDLYQSMAYAYWKAGKLLRRAVFDFVFRSSFFCGETVFGGLEECRIANFKLDDITTFRISAMPT	96
BAK05113	MAAAALANGDVRAGCGGAVFRPTNFMVTFLLDLYQSMAYAYWKAGKLLRRAVFDFVFRSSFFCGETVFGGLEECRIANFKLDDITTFRISAMPT	100
XP_009117282	V...EKENG...NQRVVEICPTNFMVTFLLDLYQSMAYAYWKAGKLLRRAVFDFVFRSSFFCGETVFGGLEECRIANFKLDDITTFRISAMPT	95
NP_195412	V...EKENG...NQRVVEICPTNFMVTFLLDLYQSMAYAYWKAGKLLRRAVFDFVFRSSFFCGETVFGGLEECRIANFKLDDITTFRISAMPT	98
OsNaPRT1	CGDGFPEVSSDCSDVEVVALEGGSVVFPKVPKMIIEGPAVVOLLETPFLINNNASLVTNNAARHRVAGKRKRLLEFGARRAQQPDGASISAVCA	199
XP_002466135	CGDGFPEVSSDCSDVEVVALEGGSVVFPKVPKMIIEGPAVVOLLETPFLINNNASLVTNNAARHRVAGKRKRLLEFGARRAQQPDGASISAVCA	196
XP_008668392	CGDGFPEVSSDCSDVEVVALEGGSVVFPKVPKMIIEGPAVVOLLETPFLINNNASLVTNNAARHRVAGKRKRLLEFGARRAQQPDGASISAVCA	196
BAK05113	CGDGFPEVSSDCSDVEVVALEGGSVVFPKVPKMIIEGPAVVOLLETPFLINNNASLVTNNAARHRVAGKRKRLLEFGARRAQQPDGASISAVCA	200
XP_009117282	SEEA...LTKGDCSDVEVVALEGGSVVFPKVPKMIIEGPAVVOLLETPFLINNNASLVTNNAARHRVAGKRKRLLEFGARRAQQPDGASISAVCA	195
NP_195412	CGDGFPEVSSDCSDVEVVALEGGSVVFPKVPKMIIEGPAVVOLLETPFLINNNASLVTNNAARHRVAGKRKRLLEFGARRAQQPDGASISAVCA	198
OsNaPRT1	MGGFDATSNVAAGLFEGIFRGTHSHAFVSSRMGLDDELDRTIASSDGSNNKCDVSLVQNWYARIKDAGSLRRIPTNISELAATISYALAFNSFLA	299
XP_002466135	MGGFDATSNVAAGLFEGIFRGTHSHAFVSSRMGLDDELDRTIASSDGSNNKCDVSLVQNWYARIKDAGSLRRIPTNISELAATISYALAFNSFLA	296
XP_008668392	MGGFDATSNVAAGLFEGIFRGTHSHAFVSSRMGLDDELDRTIASSDGSNNKCDVSLVQNWYARIKDAGSLRRIPTNISELAATISYALAFNSFLA	296
BAK05113	MGGFDATSNVAAGLFEGIFRGTHSHAFVSSRMGLDDELDRTIASSDGSNNKCDVSLVQNWYARIKDAGSLRRIPTNISELAATISYALAFNSFLA	300
XP_009117282	LGGFDATSNVAAGLFEGIFRGTHSHAFVSSRMGLDDELDRTIASSDGSNNKCDVSLVQNWYARIKDAGSLRRIPTNISELAATISYALAFNSFLA	295
NP_195412	LGGFDATSNVAAGLFEGIFRGTHSHAFVSSRMGLDDELDRTIASSDGSNNKCDVSLVQNWYARIKDAGSLRRIPTNISELAATISYALAFNSFLA	298
OsNaPRT1	LVDTYDVMISGPNFCVAVALANLGYKAVGIRLDSGDLYLISVRRKRFPAARERLLKFFVVFQKRTSIFASNDLNEETDALNKQGHVEVFGICGLVTC	399
XP_002466135	LVDTYDVMISGPNFCVAVALANLGYKAVGIRLDSGDLYLISVRRKRFPAARERLLKFFVVFQKRTSIFASNDLNEETDALNKQGHVEVFGICGLVTC	396
XP_008668392	LVDTYDVMISGPNFCVAVALANLGYKAVGIRLDSGDLYLISVRRKRFPAARERLLKFFVVFQKRTSIFASNDLNEETDALNKQGHVEVFGICGLVTC	396
BAK05113	LVDTYDVMISGPNFCVAVALANLGYKAVGIRLDSGDLYLISVRRKRFPAARERLLKFFVVFQKRTSIFASNDLNEETDALNKQGHVEVFGICGLVTC	400
XP_009117282	LVDTYDVMISGPNFCVAVALANLGYKAVGIRLDSGDLYLISVRRKRFPAARERLLKFFVVFQKRTSIFASNDLNEETDALNKQGHVEVFGICGLVTC	395
NP_195412	LVDTYDVMISGPNFCVAVALANLGYKAVGIRLDSGDLYLISVRRKRFPAARERLLKFFVVFQKRTSIFASNDLNEETDALNKQGHVEVFGICGLVTC	398
OsNaPRT1	YAQAALGCVFKLVEINQPRIKLSEDDKVSIFCKRRCYRLMGREGYPLVDIMTGDDEPFKGERLGRHFPNESKRAVVPQVVEELLKCYWEGTTSSE	499
XP_002466135	YAQAALGCVFKLVEINQPRIKLSEDDKVSIFCKRRCYRLMGREGYPLVDIMTGDDEPFKGERLGRHFPNESKRAVVPQVVEELLKCYWEGTTSSE	496
XP_008668392	YAQAALGCVFKLVEINQPRIKLSEDDKVSIFCKRRCYRLMGREGYPLVDIMTGDDEPFKGERLGRHFPNESKRAVVPQVVEELLKCYWEGTTSSE	496
BAK05113	YAQAALGCVFKLVEINQPRIKLSEDDKVSIFCKRRCYRLMGREGYPLVDIMTGDDEPFKGERLGRHFPNESKRAVVPQVVEELLKCYWEGTTSSE	500
XP_009117282	YAQAALGCVFKLVEINQPRIKLSEDDKVSIFCKRRCYRLMGREGYPLVDIMTGDDEPFKGERLGRHFPNESKRAVVPQVVEELLKCYWEGTTSSE	495
NP_195412	YAQAALGCVFKLVEINQPRIKLSEDDKVSIFCKRRCYRLMGREGYPLVDIMTGDDEPFKGERLGRHFPNESKRAVVPQVVEELLKCYWEGTTSSE	498
OsNaPRT1	FRREDSINLDRSRMGYLDLRMRDHRRLINPTPKVSVSAKLYDFIHFPLWLNPAVGEGLQ.....	560
XP_002466135	FRREDSINLDRSRMGYLDLRMRDHRRLINPTPKVSVSAKLYDFIHFPLWLNPAVGEGLQ.....	557
XP_008668392	FRREDSINLDRSRMGYLDLRMRDHRRLINPTPKVSVSAKLYDFIHFPLWLNPAVGEGLQ.....	557
BAK05113	FRREDSINLDRSRMGYLDLRMRDHRRLINPTPKVSVSAKLYDFIHFPLWLNPAVGEGLQ.....	561
XP_009117282	ARESEPLKLRDRSRMGYLDLRMRDHRRLINPTPKVSVSAKLYDFIHFPLWLNPAVGEGLQ.....	556
NP_195412	ARESEPLKLRDRSRMGYLDLRMRDHRRLINPTPKVSVSAKLYDFIHFPLWLNPAVGEGLQ.....	559

**Supplemental Figure 1.** Protein Sequence Alignment of OsNaPRT1 and Homologs.

Protein sequence alignment of OsNaPRT1 and homologs in sorghum, maize, barley, turnip, and *Arabidopsis thaliana* using Clustal W. Conserved amino acids are highlighted: white letters on a black background indicate amino acids conserved across all these samples (100% conservation). Arrowhead shows the mutant amino acid in *Its1*.



**Supplemental Figure 2.** The Phenotypes of Wild Type, Complementation and Overexpression Grains (top) and Brown Rice (bottom).  
Bars=2 mm.

**Supplemental Table 1.** Functional Classification of Differentially Expressed Genes (DEGs) in *Its1* Mutant Compared to Wild Type Plants.

Gene Ontology Nos.	Gene Ontology Annotation	Down	Up
GO:0055114	oxidation reduction	36	75
GO:0006468	protein amino acid phosphorylation	21	73
GO:0045449	regulation of transcription	31	99
GO:0006508	proteolysis	10	22
GO:0016052	carbohydrate catabolic process	6	14
GO:0005976	polysaccharide metabolic process	2	15
GO:0009057	macromolecule catabolic process	5	13
GO:0019748	secondary metabolic process	2	14
GO:0006575	cellular amino acid derivative metabolic process	4	12
GO:0005996	monosaccharide metabolic process	5	9
GO:0009072	aromatic amino acid family metabolic process	2	10
GO:0006091	generation of precursor metabolites and energy	6	7
GO:0009698	phenylpropanoid metabolic process	0	11
GO:0046394	carboxylic acid biosynthetic process	4	13
GO:0051186	cofactor metabolic process	6	5
GO:0044271	nitrogen compound biosynthetic process	5	13
GO:0006811	ion transport	24	17
GO:0055085	transmembrane transport	5	6
GO:0007242	intracellular signaling cascade	3	10
GO:0006979	response to oxidative stress	2	11
GO:0010033	response to organic substance	4	8
GO:0009719	response to endogenous stimulus	3	8
GO:0006952	defense response	4	15
GO:0012501	cell death	1	8
Unknown	Unknown function	65	137
Total		256	625

**Supplemental Table 2.** Senescence-related Genes Identified by Affymetrix Microarray Analysis as Being Differentially Expressed in *Its1* Mutant Plants.

<b>Locus</b>	<b>Annotation</b>	<b>Fold change</b>
<b>Up-regulated</b>		Log2 ratio
LOC_Os09g35630	BAG domain-containing protein	2.15
LOC_Os12g36720	RGH1A	1.48
LOC_Os08g29854	RGH1A	1.17
LOC_Os06g41480	vrga1	1.17
LOC_Os02g35490	MLO domain containing protein	1.15
LOC_Os11g45930	NBS-LRR type disease resistance protein	1.10
LOC_Os11g13430	RGH1A	1.04
LOC_Os11g12330	disease resistance protein RPM1	1.01
<b>Down-regulated</b>		
LOC_Os11g31060	IQ calmodulin-binding and BAG domain containing protein	-1.27

**Supplemental Table 3.** PCR Primers Used in This Study.

<b>Primer Name</b>	<b>Primer Sequence</b>	<b>Description</b>
P1	AAGGAAAGAGTTGTCCGTAAT CCTGTAAGAAGATAGGGTCAAGAG	Fine mapping Fine mapping
P2	TGGTGGTAGTATTAGCCTTTGT TTCTTTCAGGAGACTTGGGAAC	Fine mapping Fine mapping
P3	GGGTCCTAGTCCTTTCTTTCCG AACTTTGCCTTTGCTTTGCCTC	Fine mapping Fine mapping
P4	TGCCAGCCTAGCGAGCCTAA ATTGCAGCGAGCTACACG	Fine mapping Fine mapping
P5	ATGGCTTCAGACTTCAGAGT CAAATTAACCTTCAGGCAAG	Fine mapping Fine mapping
ID-Na	TCCACTGTCCCTAAATCACC TCCTTCTGCCTCGTCCAT	Identification for osnaprt1 Identification for osnaprt1
ComNa1	CTGCAGGCAGGACATGCAGATGGAATGATGTCAGTG GAGCTCACTTGATACCTGGCTGCCTCTAACACTAGG	Complementary construction Complementary construction
ComNa2	GAGCTCTATGGGAGGATTTGATGCAACAAGGTCTGG GAGCTCCGCGCGGAGAGCTCCGGCGATGTCCTTGACGAGGAAGCG	Complementary construction Complementary construction
OE	GGATCCATGGCGGCGGCGGCGGCAGCGG CTGCAGTCATTGCAGTTCGCCTACCGGA	Overexpression construction Overexpression construction
AntiNa	GGATCCATGGCGGCGGCGGCGGCAGCGG CTCGAGTTGCAGTTCGCCTACCGGAGCT	Antibody of OsNaPRT1 Antibody of OsNaPRT1
qACTIN	GACCCAGATCATGTTTGAGACCT CAGTGTGGCTGACACCATCAC	qRT-PCR Analysis qRT-PCR Analysis
qNaPRT1	GCATACTTATCCGTTGAAACTCG GCATCTACCTCGTGACCCTG	qRT-PCR Analysis qRT-PCR Analysis
EGFP	CGGGATCCATGGCGGCGGCGGCGGCA GCTCTAGATTGCAGTTCGCCTACCGGAGCTTCG	Sub-cellular localization Sub-cellular localization
qNIC	GCCAGTCTTTGCGTTTCTTG CCTTTTCCAGCCACTCCAG	qRT-PCR Analysis qRT-PCR Analysis
qSRT1	GAAGTTCTGGGAGCAAGATTTT TGAACCAACCACTAGAAGAGCA	qRT-PCR Analysis qRT-PCR Analysis
qSRT2	ACTTTAGTGATGGTTGCGGCT CACGTGATCGATGCTCTGC	qRT-PCR Analysis qRT-PCR Analysis
qOsh36	GCACGGAGGCGAACGA TTGAGCGGTAGCACCCATT	qRT-PCR Analysis qRT-PCR Analysis
qOsl57	ACCCTAAAGTAAATGAAGTC CCTGCTCTTGCTTTGTTA	qRT-PCR Analysis qRT-PCR Analysis
qOsh69	CCACAACACGGATAACTT GGTGAACACTATGGAACA	qRT-PCR Analysis qRT-PCR Analysis
Ch-LOC_Os09g35630	GCCACTCCCTTCCCCAAT CGCAGCTAAAGCTCGCAA	ChIP-PCR Assay ChIP-PCR Assay
Ch-LOC_Os12g36720	GCAGCTTAATTATTCAGATGTCGT TGAGCCTCTTGAGTTTATCAGTATG	ChIP-PCR Assay ChIP-PCR Assay
Ch-LOC_Os08g29854	ATTCGTCTTCCCCTCGG GAAATGGGGAATTGGGGAT	ChIP-PCR Assay ChIP-PCR Assay
Ch-LOC_Os02g35490	TTCTCTCCCCGCACCTCTAC GAGAATGTCAAACCTCAAACCTGGG	ChIP-PCR Assay ChIP-PCR Assay
Ch-LOC_Os11g45930	CACTTACTTGTCTGATTTTGCACCTC ATCCTCCAAGTCGTCTGCTAAG	ChIP-PCR Assay ChIP-PCR Assay