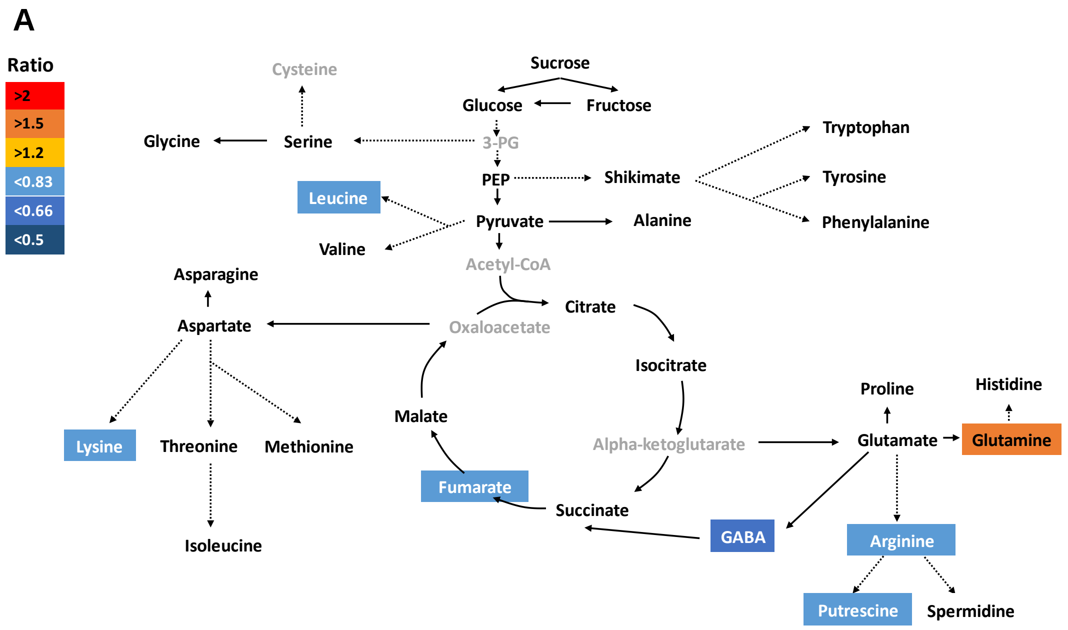
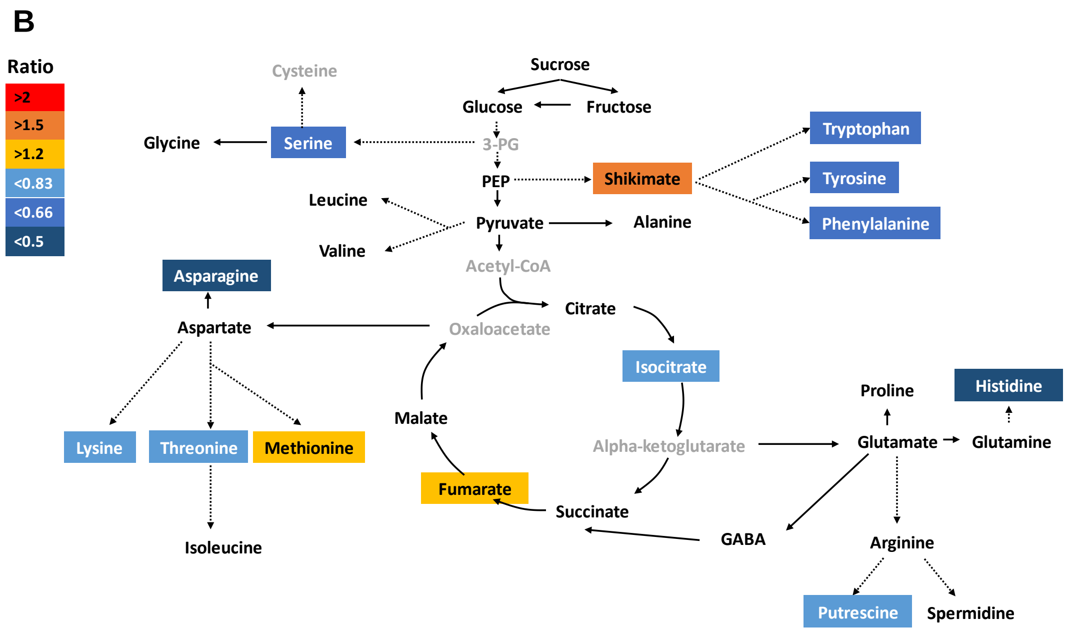
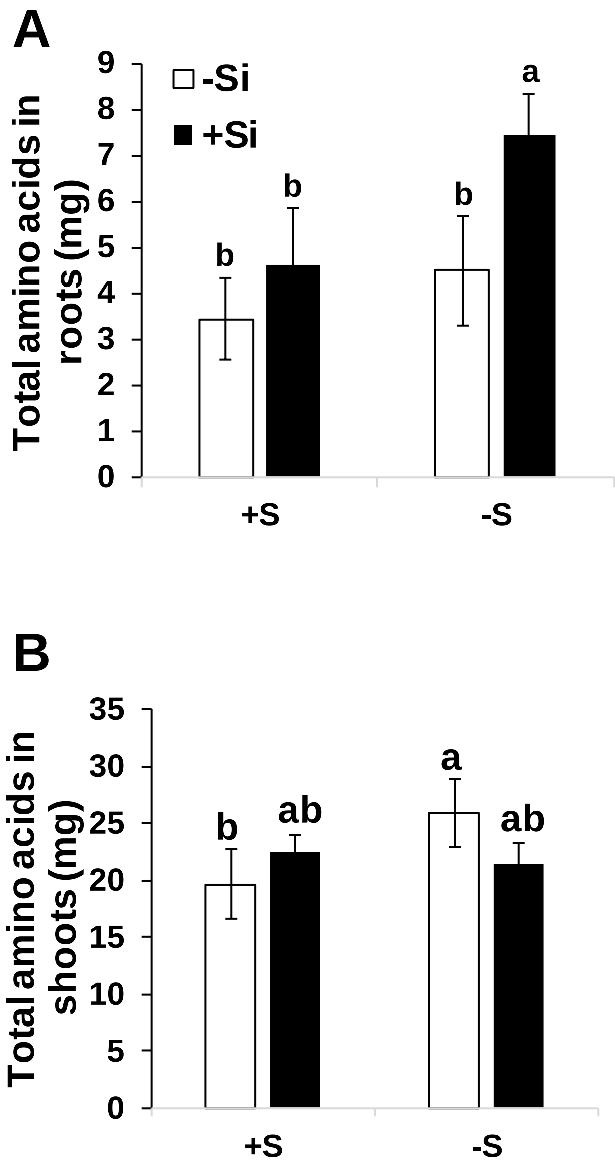




Supplementary Figure S1. Influence of silicon application on the concentrations of primary metabolites of rice roots and shoots under ample S condition. Schematic representation of primary metabolites under ample S and in response to Si application. (A) root and (B) shoot. Plants were grown in hydroponic culture under normal S (1.5 mM) as well as 2 mM of Si. Roots and shoots were harvested for metabolite profiling after 15 days of treatments. Metabolites were coloured according to the ratio of normal S supply treated with Si to normal S supply without Si treatment (light blue to dark blue: decrease; yellow to red: increase). The grey colour indicated the unquantified metabolites. Only the metabolites which presented statistically significant differences were presented. Solid arrows denote single reactions, whereas dotted arrows indicate that some intermediate metabolites are not shown. Statistical analysis was done according to ANOVA followed by SNK test ($p<0.05$; $n=4$).



Supplementary Figure S2: Influence of silicon application on the total amino acid accumulation in rice shoots and roots exposed to S deficiency. (A) Total amino acid in roots and (B) total amino acid in shoots. Plants were grown in hydroponic culture under either low (0 mM) or normal S (1.5 mM) as well as 2 mM of Si. Roots and shoots were harvested after 15 days of treatment for amino acid analysis. Data correspond to the accumulation of total amino acids in three pooled plants in mg. Different letters denote significant difference according to ANOVA followed by SNK test ($p<0.05$; $n=4$).

Supplementary Table S1: Results of Two-Way ANOVA examining the effects of Sulfur, Silicon and their interaction on roots and shoot biomass as well as macro-elements, metabolites and phytohormones in plants exposed to short and long-term S deficiency and Si application.

Shoot	Fresh weight (g FW)		K (mg g^{-1} DW)		S (mg g^{-1} DW)		Si (mg g^{-1} DW)		P (mg g^{-1} DW)	
	F-value	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*
Sulfur	0.063	0.802	2.032	0.18	84.426	8.87e-07 ***	18.95	0.00094 ***	19.41	0.000857 ***
Silicon	29.622	2.21e-06 ***	0.466	0.508	58.007	6.20e-06 ***	1857.03	1.58e-14 ***	148.48	4.08e-08 ***
Sulfur:Silicon	0.011	0.919	1.332	0.271	0.175	0.683	17.7	0.00122 **	0.987	0.340052

Root	Fresh weight (g FW)		K (mg g^{-1} DW)		S (mg g^{-1} DW)		Si (mg g^{-1} DW)		P (mg g^{-1} DW)	
	F-value	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*
Sulfur	7.517	0.008804 ***	9.028	0.0110 *	237.026	2.88e-09 ***	10.805	0.00724 **	25.621	0.000279 ***
Silicon	13.581	0.000623 ***	0.362	0.5588	0.011	0.917	395.413	5.69e-10 ***	53.441	9.34e-06 ***
Sulfur:Silicon	0.339	0.563614	7	0.0213 *	1.517	0.242	0.363	0.55925	1.006	0.335692

Ca (mg g^{-1} DW)		Mg (mg g^{-1} DW)		N (mg g^{-1} DW)		NH$_4^+$ (mg g^{-1} DW)		NO$_3^-$ (mg g^{-1} DW)		SO$_4^{2-}$ (mg g^{-1} DW)	
F-value	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*
0.05	0.826	1.94	0.189	10.527	0.00703 **	0.684	0.425	23.986	0.000625 ***	73.41	1.85e-06 ***
79.159	1.25e-06 ***	212.569	5.38e-09 ***	121.247	1.25e-07 ***	87.797	7.2e-07 ***	0.2	0.66562	17.16	0.00136 **
0.628	0.444	0.073	0.792	2.656	0.12913	1.899	0.193	9.156	0.012767 *	0.53	0.4804

Ca (mg g^{-1} DW)		Mg (mg g^{-1} DW)		N (mg g^{-1} DW)		NH$_4^+$ (mg g^{-1} DW)		NO$_3^-$ (mg g^{-1} DW)		SO$_4^{2-}$ (mg g^{-1} DW)	
F-value	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*
1.755	0.21	8.367	0.0135 *	0.131	0.723	8.417	0.0133 *	45.351	2.09e-05 ***	272.056	1.31e-09 ***
1.133	0.308	1.307	0.2752	2.422	0.146	0.029	0.8673	1.011	0.334	5.651	0.0349 *
1.634	0.225	8.455	0.0131 *	0.001	0.979	3.524	0.085	2.796	0.12	1.114	0.312

Total amino acids (mg)		Glutamine (mg g^{-1} DW)		Proline (mg g^{-1} DW)		GABA (mg g^{-1} DW)		Citrate (mg g^{-1} FW)		Isocitrate (mg g^{-1} FW)	
F-value	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*
5.027	0.0465 *	0.067	0.8005	18.776	0.001188 **	14.24	0.003077 **	7.845	0.016 *	4.409	0.05757
0.157	0.6995	12.915	0.00422 **	23.401	0.000521 ***	33.74	0.000118 ***	0.186	0.674	43.69	2.5e-05 ***
7.91	0.0169 *	6.272	0.02927 *	1.725	0.215812	11.33	0.006303 **	0.004	0.948	11.243	0.00575 **

Total amino acids (mg)		Glutamine (mg g^{-1} DW)		Proline (mg g^{-1} DW)		GABA (mg g^{-1} DW)		Citrate (mg g^{-1} FW)		Isocitrate (mg g^{-1} FW)	
F-value	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*
13.437	0.00372 **	5.625	0.037 *	9.681	0.00990 **	2.681	0.129838	63.88	3.8e-06 ***	17.89	0.001169 **
14.884	0.00266 **	41.783	4.65e-05 ***	19.243	0.00109 **	0.196	0.666673	13.27	0.00337 **	16.45	0.001594 **
2.535	0.13965	0.046	0.834	10.428	0.00803 **	24.797	0.000416 ***	11.23	0.00577 **	21.37	0.000587 ***

Abscisic acid (µg g^{-1} FW)		Salicylic acid (µg g^{-1} FW)		Jasmonic acid (µg g^{-1} FW)		Jasmonic acid-Isoleucine (µg g^{-1} FW)	
F-value	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*	*F-value*	*Pr(>F)*
54.68	8.33e-06 ***	6.107	0.0310 *	1.689	0.223	51.65	5.16e-05 ***
23.81	0.000379 ***	6.596	0.0261 *	0.898	0.366	48.8	6.42e-05 ***
11.03	0.006094 **	4.198	0.0651	0.301	0.595	18.66	0.00194 **

Supplementary Table S2: Influence of silicon application on the total level of macro-elements in roots and shoots of rice plant exposed to sulfur deficiency. Plants were grown in hydroponic culture under either low (0 mM) or normal S (1.5 mM) as well as 2 mM of Si. Roots and shoots were harvested after 15 days of treatment for elemental analysis. Data are expressed as mean ± SD in mg for three pooled plants. Different letters denote significant difference according to ANOVA followed by SNK test ($p<0.05$; n=4). Abbreviations are: S: sulfur; Si: silicon; N: nitrogen; P: phosphorous; K: potassium; Mg; magnesium; Ca: calcium; No_3^-: nitrate; NH_4^+: ammonium and SO_4^{2-}: sulfate.

		Roots				Shoots			
		+S-Si	+S+Si	-S-Si	-S+Si	+S-Si	+S+Si	-S-Si	-S+Si
Macro-elements	S	1.95 ± 0.39^{ab}	2.48 ± 0.43^{a}	1.64 ± 0.27^{b}	2.08 ± 0.18^{ab}	9.6 ± 1.59^{a}	10.23 ± 0.86^{a}	7.48 ± 0.94^{b}	6.69 ± 0.66^{b}
	Si	1.67 ± 0.25^{b}	7.34 ± 1.64^{a}	1.52 ± 0.38^{b}	8.48 ± 1.34^{a}	6.41 ± 0.93^{c}	263.73 ± 28.26^{a}	6.64 ± 1.15^{c}	221.62 ± 31.13^{b}
	N	14.90 ± 3.50^{b}	17.69 ± 2.43^{b}	17.58 ± 3.28^{b}	22.34 ± 2.11^{a}	81.96 ± 16.25^{ns}	97.95 ± 8.09^{ns}	87.53 ± 9.12^{ns}	90.72 ± 11.80^{ns}
	P	4.64 ± 1.01^{ns}	4.84 ± 0.63^{ns}	4.89 ± 0.65^{ns}	5.60 ± 0.35^{ns}	22.83 ± 5.18^{ns}	19.98 ± 1.57^{ns}	21.15 ± 3.40^{ns}	17.19 ± 1.30^{ns}
	K	15.24 ± 3.83^{b}	17.71 ± 2.04^{b}	15.66 ± 2.93^{b}	22.32 ± 1.69^{a}	83.87 ± 19.24^{ns}	109.66 ± 12.44^{ns}	82.96 ± 10.01^{ns}	110.50 ± 16.47^{ns}
	Mg	1.16 ± 0.22^{b}	1.97 ± 0.59^{a}	1.39 ± 0.23^{ab}	1.53 ± 0.18^{ab}	10.51 ± 2.00^{a}	7.82 ± 0.83^{b}	11.14 ± 1.72^{a}	7.15 ± 1.06^{b}
	Ca	0.77 ± 0.17^{ns}	0.98 ± 0.23^{ns}	0.92 ± 0.13^{ns}	1.08 ± 0.15^{ns}	11.25 ± 2.49^{ab}	8.95 ± 0.74^{b}	13.07 ± 2.57^{a}	8.61 ± 0.87^{b}
Ions	NO_3^-	6.78 ± 2.46^{b}	9.51 ± 1.34^{a}	5.36 ± 0.99^{b}	6.60 ± 0.85^{b}	11.48 ± 3.06^{b}	20.82 ± 1.28^{a}	10.56 ± 0.27^{b}	8.55 ± 5.26^{b}
	NH_4^+	0.10 ± 0.03^{b}	0.11 ± 0.01^{b}	0.12 ± 0.02^{b}	0.17 ± 0.01^{a}	0.42 ± 0.07^{ab}	0.37 ± 0.05^{b}	0.51 ± 0.06^{a}	0.36 ± 0.08^{b}
	SO_4^{2-}	1.56 ± 0.43^{b}	2.21 ± 0.38^{a}	0.56 ± 0.12^{c}	0.88 ± 0.19^{c}	8.94 ± 1.81^{a}	8.76 ± 1.58^{a}	3.93 ± 0.56^{b}	2.22 ± 0.28^{b}

Supplementary Table S3: List of primers used for qRT-PCR.

GENE	FORWARD PRIMER	REVERSE PRIMER	AMPLICON SIZE (BP)
OsLsi1	ACCTACACCTTCATCCGCTT	TCGTCGTCCTATCACACTTGG	154
OsLsi2	CCGTCCTCTCCGTCATCATCC	CTTCGCCACCTCATCACCCA	86
OsLsi6	ATCTACGGCGAGGACATGAAG	GGAAGAAGGCGAAGGAGAGG	145
OsSULTR1;1	GCCGATGTCAAAGAAGGTGT	CAGAGGCTGGCAATGGTG	126
OsSULTR1;2	TTCATCTGTGGAGTATGGCTTG	ATTAGCATCCCTGGCACCTT	168
OsSULTR2;1	TCGTCTTCACCGTCACCTTC	GAAATCCACCAGGAAACCCAAC	80
OsSULTR2;2	ATGCGACAAGAGCGGATAAG	TCACAGCACAAACAAGAGCA	141
OsActin	TCGTGAGAAGATGACCCAGA	ACCAGAGTCCAACACAATACC	124
Osβ-tubulin	ACCGTGCCCTTACTGTTCCT	CCTCCTTGGTGCTCATCTTTCC	135
OsEF1α	AAGATGATTCCCACCAAGCCC	ACAGCCACCGTTTGCCTC	98
OsGAPDH	CTGCCTTGCTCCACTTGCC	AGGGTCCATCAACGGTCTTCT	110